FEASIBILITY OF A TOLL ROAD

BETWEEN

SAN FRANCISCO AND LOS ANGELES

A REPORT TO THE LEGISLATURE OF CALIFORNIA

COMPILED BY THE

HIGHWAY PLANNING SURVEY

CONDUCTED BY THE

U.S. BUREAU OF PUBLIC ROADS

AND THE

CALIFORNIA DIVISION OF HIGHWAYS

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January 12, 1951

Mr. C. H. Purcell
Director of Public Works

Transmitted herewith is a report on the feasibility of a toll road between San Francisco and Los Angeles. It was prepared in accordance with the request in Senate Concurrent Resolution No. 6 which was adopted in the Senate April 3, 1950, and in the Assembly on April 4, 1950. Compilation was done under a cooperative project between the U. S. Bureau of Public Roads and the Division of Highways.

Your attention is directed to the conclusion that at this time a toll road from a terminus in San Francisco to one in Los Angeles is not feasible. Further, no toll route seems financially practicable over a major part of the distance. I concur in the conclusion.

G T McCoy

G. T. McCOY
State Highway Engineer

Attachment

Mr. G. T. McCoy January 12, 1951

Transmitted herewith is a report on the feasibility of a toll road between San Francisco and Los Angeles. It was prepared in accordance with the request in Senate Concurrent Resolution No. 6.

I concur in the conclusions of the report.

J. W. Vickrey

Attachment

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SUMMARY OF FINDINGS

It is concluded in this report that a toll road between Los Angeles and San Francisco is not financially feasible at this time. This conclusion rests upon an analysis involving: (1) traffic information obtained in a field survey; (2) estimated costs of construction, maintenance, operation, administration, and financing of the toll facilities considered; and (3) revenue potentialities of these toll facilities.

The conclusion applies alike to a route covering the entire distance from Los Angeles to San Francisco or to any of four routes covering a major part of the distance. The latter all have a common starting point at Wheeler Ridge between Bakersfield and the Grapevine on existing State Highway Route 4 -- the Valley Route. They are briefly described as going by way of:

> Carrizo Plains, Salinas and Santa Clara Valleys and along the east side of San Francisco Bay -- Route A;
>
> The west side of the San Joaquin Valley to Tracy and the Altamont Pass -- Route C;
>
> The west side of the San Joaquin Valley, through the Pacheco Pass -- Route C_1;
>
> Hanford to a point 10 miles west of Fresno, and then to Tracy -- Route D.

More concisely yet, these are referred to as Carrizo Plains, West Side, Pacheco, and Hanford.

The present distance from Los Angeles to San Francisco is 407 miles via the San Joaquin Valley and 440 miles via the

Coast Route. Any of the routes studied would be from 11 to 17 miles shorter than the Valley Route and from 44 to 50 miles shorter than the Coast Route.

Average daily traffic in 1949 was:

Valley Route	9,444 vehicles
Coast Route	6,579 vehicles

The flow of traffic on the Valley Route has increased a little more rapidly than it has on the Coast Route. In the period 1940 to 1949 the increases were:

Valley Route	39.2 per cent
Coast Route	31.6 per cent

During the summer of 1950 origins and destinations of vehicles were obtained at 13 locations, most of which were on the Valley and Coast Routes. It was found that approximately 79,000 trips pertinent to the study occurred each weekday. The average air-line distance of these trips was 80 miles; 50 per cent of them were less than 50 miles, and 89 per cent were less than 200 miles.

Taking the routes one at a time, approximately one out of every four in the daily flow of 79,000 trips was considered a possible user of some portion of Routes A, C, and C_1. On Route D, the proportion was higher, one in three.

These trips, the short and the long, were converted into terms of average daily vehicles over the entire length of each route. It was found that had any of the routes been in existence and operating as a free highway in 1950, the average daily traffic would have been about:

Route	Via	No. of Vehicles Daily
A	Carrizo Plains	3776
C	West Side	3860
C_1	Pacheco	4038
D	Hanford	6176

Costs of construction as toll roads, including interest during construction, were estimated at:

Route	Via	Cost
A	Carrizo Plains	$172,720,000
C	West Side	125,015,000
C_1	Pacheco	144,053,000
D	Hanford	150,156,000

Total costs for amortization of 30-year, 3-1/4 per cent bonds, maintenance, toll collection and administration were estimated to be:

Route	Via	Cost
A	Carrizo Plains	$336,080,000
C	West Side	247,584,000
C_1	Pacheco	282,139,000
D	Hanford	294,116,000

Redemption of debt would account for approximately 51 per cent of the total cost; interest, 35 per cent; maintenance, 5 per cent; and toll collection and administration, 9 per cent.

The earnings position of any of the routes would be nearly parallel to that of the Maine Turnpike. Accordingly, toll charges were assumed comparable to those in Maine: 1 cent per vehicle mile for autos, and 2 cents for trucks, or 1.22 cents for the entire stream of traffic.

It was estimated that traffic will triple in 30 years. This rate of increase was used to determine the maximum traffic that could be expected to make use of the routes if they were operated as free routes.

Next, it was found that at a toll charge of 1.22 cents per vehicle mile the following percentages of such traffic would be needed for solvency:

Route	Via	Per Cent
A	Carrizo Plains	Over 100
C	West Side	89.5
C_1	Pacheco	89.8
D	Hanford	65.0

In view of the fact that none of the routes would have a monopolistic position with respect to traffic but would, on the contrary, face the competition of free parallel routes, it is deemed unreasonable to expect that such percentages of estimated free-road traffic could be induced to use the facilities on a toll basis; forty per cent is judged to be the maximum.

If only 40 per cent of the traffic that would use a free-road could be induced to patronize a toll road, toll rates like these would be needed:

		Cents Per Vehicle Mile		
Route	Via	Average for all Vehicles	Autos	Trucks
A	Carrizo Plains	3.36	1	11.73
C	West Side	2.73	1	8.87
C_1	Pacheco	2.74	1	8.90
D	Hanford	1.98	1	5.47

It is not believed these high rates could be obtained. They are higher than those on the Pennsylvania Turnpike, which has advantages, particularly for trucks, that none of the facilities studied in California would possess. In 1949 the average toll in Pennsylvania for all vehicles was 1.76 cents.

I

ROUTES STUDIED

Senate Concurrent Resolution No. 6 provides as follows:

> WHEREAS, Existing highway routes between San Francisco and Los Angeles run through many populous areas; and
>
> WHEREAS, The increasing growth of the population of this State, together with the presence of a large number of visitors in the State, have greatly increased the demand upon the highways in the State, particularly those running between Los Angeles and San Francisco; and
>
> WHEREAS, A modern expressway between these cities similar to those connecting metropolitan areas in other sections of the Country would greatly relieve traffic congestion and its resulting hazards over the State Highway System; and
>
> WHEREAS, The feasibility of such an express highway from the viewpoints of engineering and financing is a matter upon which the Legislature should be informed; now, therefore, be it
>
> Resolved by the Senate of the State of California, the Assembly thereof concurring, That the Department of Public Works, through the Division of Highways, is requested to investigate the feasibility of constructing an expressway between Los Angeles and San Francisco to be financed by the issuance of revenue bonds to be paid by the collection of tolls for the use of the highway, such highway to eventually become toll-free, and to report its findings thereon to the Legislature not later than January 15, 1951; and be it further
>
> Resolved, That the Secretary of the Senate is directed to transmit copies of this resolution to the Director of Public Works and the State Highway Engineer.

This resolution requires a report on a single expressway; and it involves making a choice, since there are several routes possible between the termini of San Francisco and Los Angeles. The problem of determining which route is the most feasible has been approached by first setting up an area within which all practicable routes must fall. The area is comprised of 23 mid-state counties. (Plate 1). Within it, the higher peaks of the Diablo Range in the north and the Temblor in the south coincide closely with the straight line between Los Angeles and San Francisco -- most are within eight miles of it. Clearly, any route closely approaching a straight line is impractical.

The mountain ranges that thus divide the mid-state area give rise to two questions. Should the proposed route lie wholly to the west or to the east of the mountains? Is it practicable to penetrate either mountain range so that one portion of the route lies to the west and another to the east? With these particular points in mind, and others normal to all highway location, four routes have been selected for study.

Descriptions of Routes

The four routes are sketched in Plate 2. For reasons that will be explained shortly, the southerly terminus is at Wheeler Ridge, just north of the Grapevine; and the stretch between Los Angeles and Wheeler Ridge is common to all routes studied. In more detail the descriptions are:

Route A - Starting at existing State Highway Route 4 near Wheeler Ridge; thence northwesterly over the Carrizo Plains to

PLATE 1

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STATE OF CALIFORNIA

LOS ANGELES-SAN FRANCISCO *Area* TOLL ROAD STUDY

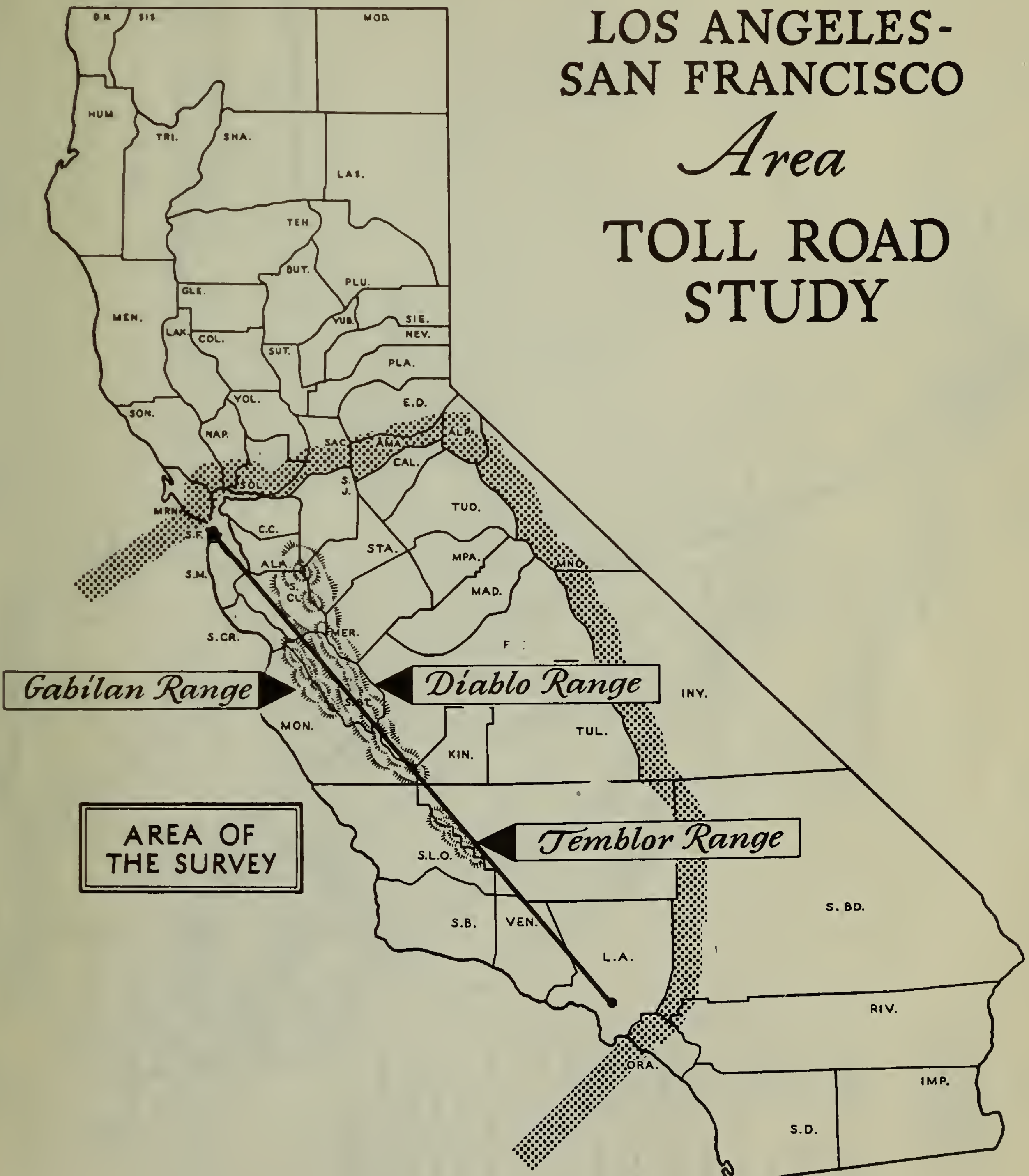
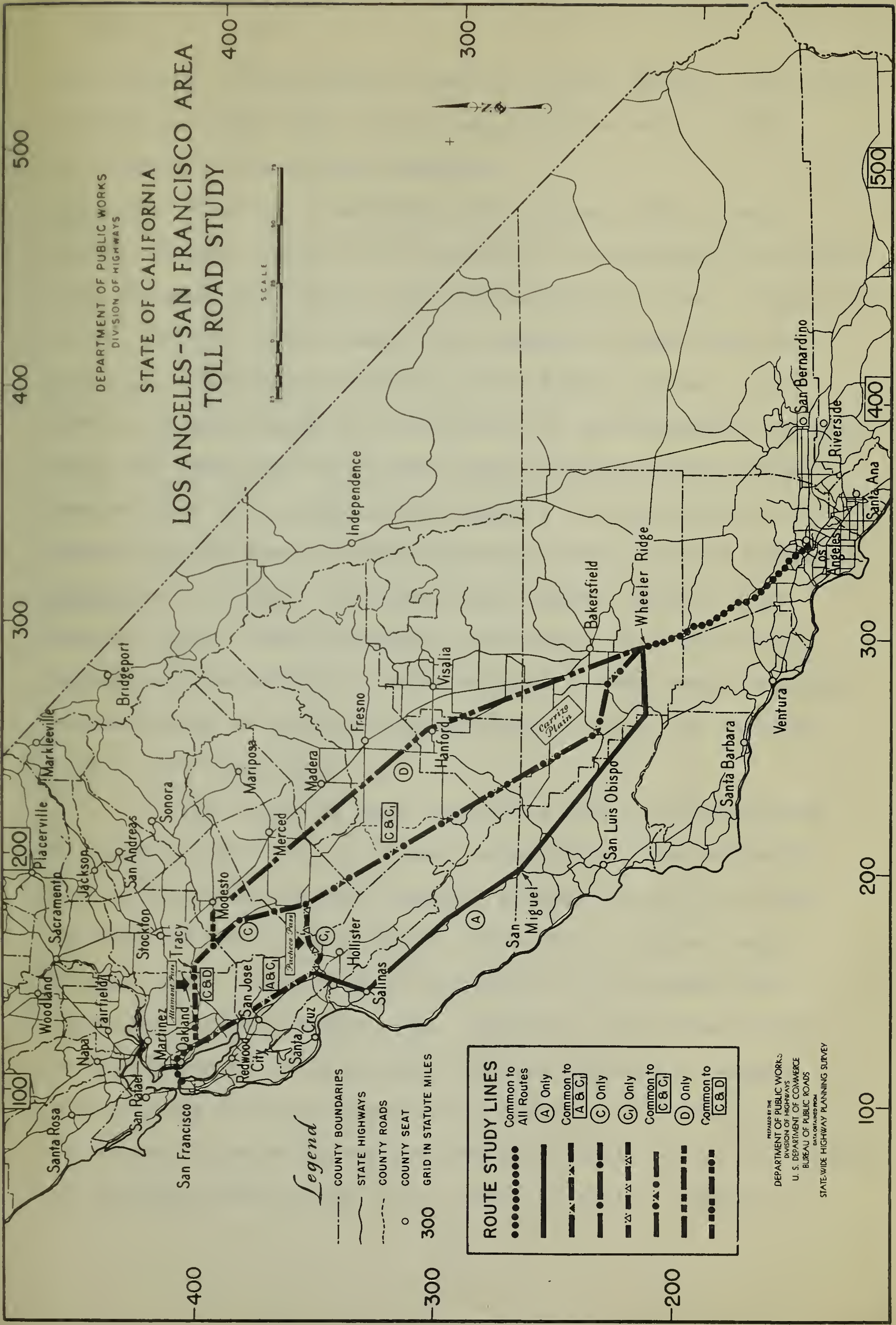


PLATE 2



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the vicinity of San Miguel; down the Salinas Valley; and thence through the Santa Clara Valley and along the east side of San Francisco Bay to San Francisco.

Route C - Starting at existing State Highway Route 4 near Wheeler Ridge; thence at an elevation of approximately 500 feet, down the west side of the San Joaquin Valley to the vicinity of Tracy, and over the Altamont Pass westerly to San Francisco.

Route C_1 - Starting at existing State Highway Route 4 near Wheeler Ridge; thence at an elevation of approximately 500 feet, along the west side of the San Joaquin Valley to and through Pacheco Pass to a junction with Route A in the vicinity of Gilroy; thence over the same course as Route A to San Francisco.

Route D - Starting at existing State Highway Route 4 near Wheeler Ridge; thence northerly via Hanford to a point near Kerman, approximately ten miles west of Fresno, and continuing northwesterly to the vicinity of Tracy and over the Altamont Pass to San Francisco.

The length of each route from terminus to terminus is shown in Table 1. It is well worth noting that although the extreme east and west distance between any pair of routes is about 70 miles, the greatest difference in gross length between any of the routes is six miles -- via Pacheco Pass 390 miles, Carrizo Plains, 396. Route C_1, via Pacheco Pass, is the shortest; it is 50 miles shorter than State Highway Route 2, and 17 miles shorter than Route 4. Allowance should, of course, be made for deflections which would narrow the margins of difference should any of the roads be built. Perhaps it

TABLE 1

COMPARATIVE DISTANCES
BETWEEN
SAN FRANCISCO AND LOS ANGELES

Route	Brief Description	Miles From San Francisco To Los Angeles	Wheeler Ridge to Tracy or San Jose			
				Number of Major Structures		
			Miles	Traffic Interchanges	Road Separations	Railroad Separations
2	Coast (Existing Route)	440	-	-	-	-
4	Valley (Existing Route)	407	-	-	-	-
A	Carrizo Plains	396	264	21	120	17
C	West Side	392	240	14	103	4
C_1	Pacheco Pass	390	258	15	105	7
D	Kerman	392	240	17	188	17

Excluded Mileage:

Los Angeles to Wheeler Ridge	92
Near Tracy to San Francisco	60
North of San Jose to San Francisco . . .	40

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is also worthwhile noting that the difference between the longest of the routes studied and the air-line distance is approximately 14 per cent. Existing Routes 2 and 4 exceed the air-line distance, 347 miles, by 27 per cent and 17 per cent, respectively.

Preliminary studies indicate that none of these routes is practicable as a toll road throughout its entirety. Take, for example, the situation on the existing section of State Highway Route 4 between Los Angeles and Wheeler Ridge. No superior location has been found that would involve a lesser distance and a lower summit. Now, it would be unrealistic to build at great expense a new facility closely parallel to the existing route from Wheeler Ridge to San Fernando. A driver would gain little, if anything, by paying a toll for its use. And from San Fernando south, where many closely parallel routes already exist, attracting traffic to a toll road would be exceedingly difficult.

If early toll road precedents were followed and an Authority granted the power to take over repair, and improve existing roads, a monopoly could be readily created on the road over the mountains, but from San Fernando south there could be no monopoly. It thus makes little difference whether the old precedents are followed or shunned. The only apparent alternative would be to operate the road from Los Angeles to Wheeler Ridge as a free road.

For similar reasons it has been assumed that in the north closely parallel and competing facilities would not be

warranted either west of Tracy in the Altamont Pass, or north of San Jose where State Highway Route 69 is rapidly being extended. However, these circumstances do not preclude the possibility of toll roads, profitable or otherwise, over the greater length of each route. Therefore, after making allowance for them, the remaining mileage of each route is studied as a toll road.

II

TRAFFIC PATTERN OF THE MID-STATE AREA

Chief concern with traffic in this study is with that flowing predominantly north and south. There are five routes* where this condition prevails:

Route 56 -- Along the Coast via Carmel and San Simeon.
Route 119 -- In the valley of the San Benito River via Hollister.
Route 41 -- From Tracy and along the west side of the San Joaquin Valley.
Routes 2 and 4 -- The Coast Route and the San Joaquin Valley Route.

It will be seen in Plate 3 that the average daily traffic on any of the first three is less than 2,500 vehicles. Sustained high levels of traffic exist only on Routes 2 and 4. The traffic flow on the Valley Route is clearly above 5,000 vehicles daily for practically its entire length, and many sections, such as those at Bakersfield, Fresno, Madera, Modesto, etc., carry over 10,000. The level of traffic is obviously lower on Route 2, but even on it no section carries less than 2,500.

Table 2, which covers the past eleven years, shows that the average daily flow on the Valley Route connecting San Francisco and Los Angeles has been greater than that on the Coast Route; and during the passage of time the flow in the Valley has increased a little more rapidly than it has on the

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* They are shown in detail in the Road Map of California in the Appendix.

PLATE 3

RURAL STATE HIGHWAYS IN 1949

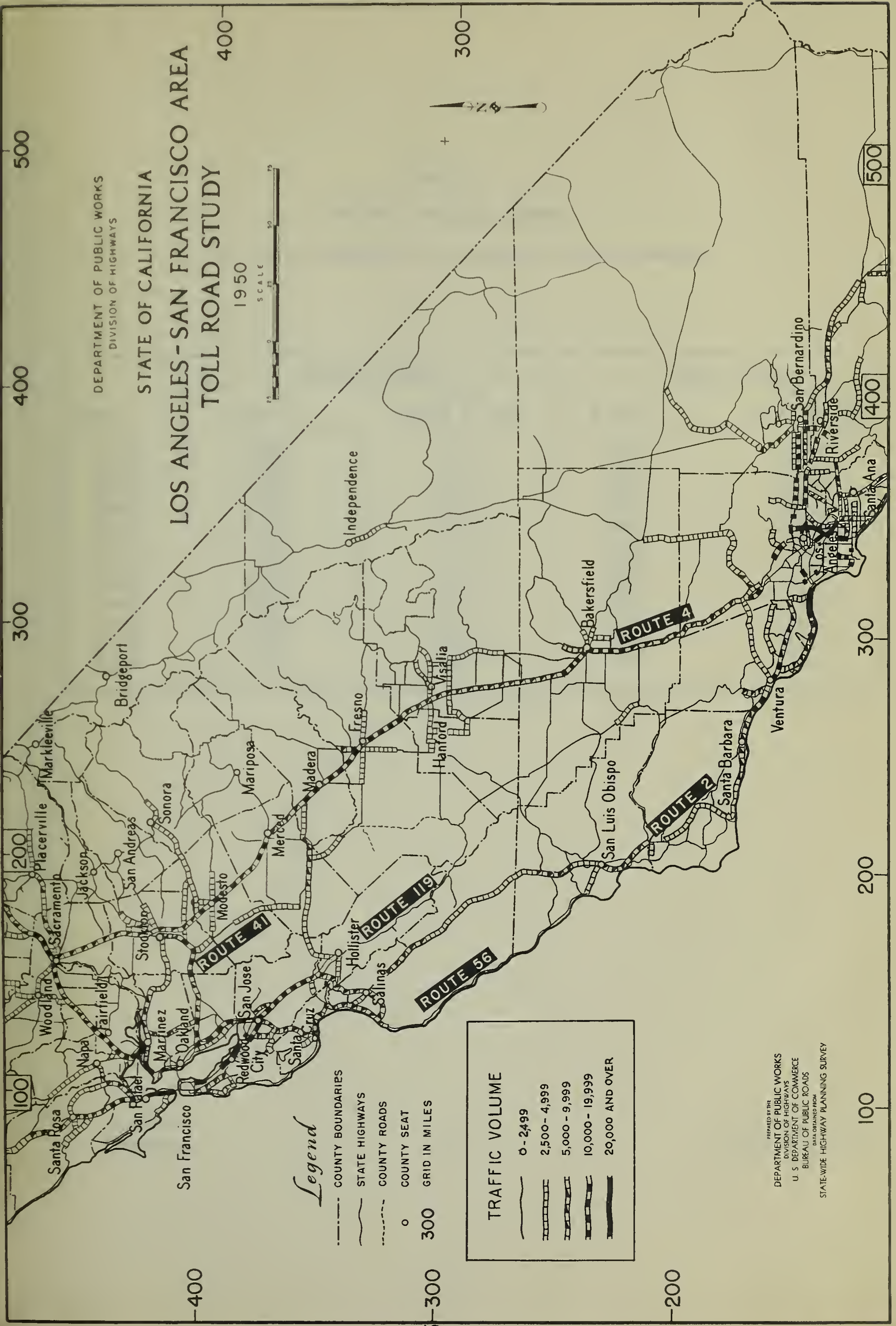

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TABLE 2

TRAFFIC VOLUME TRENDS

On Rural Portion of Valley and Coast Routes

Year	Valley Route		Coast Route	
	A.D.T.	Index 1940 = 100	A.D.T.	Index 1940 = 100
1938	5381	79.3	4308	86.2
1939	6052	89.2	4964	99.3
1940	6786	100.0	5000	100.0
1941	7315	107.8	5684	113.7
1942	6121	90.2	4406	88.1
1943	5036	74.2	3392	67.8
1944	5030	74.1	3304	66.1
1945	6238	91.9	4136	82.7
1946	8458	124.6	5723	114.5
1947	9329	137.5	6303	126.1
1948	8751	129.0	5881	117.6
1949	9444	139.2	6579	131.6

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[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

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Coast Route. In 1949 the average daily traffic on the Valley Route was 9,444 vehicles; it exceeded that on the Coast Route by almost 44 percent.

Such high flows of traffic impose a severe burden on highway and traveler alike, unless the former is of adequate width. A quick indication of the burden can be had. Generally 2-lane highways are considered inadequate and multiple highways necessary where the average daily traffic exceeds 5,000 vehicles. In respect to this single criterion it is found that: On the rural portions of the Valley Route 54 percent of the mileage carries over 5,000 vehicles daily yet it is less than four lanes in width; the comparable percentage on the Coast Route is 38 percent.

Although the traffic map and Table 2 give a good idea of where and what the traffic burden is on the existing State Highways, they fail completely to indicate the number of trips from place to place -- information which is essential where proposals to change the road pattern are being considered. To obtain such information, an Origin and Destination Survey was made in June and July of 1950. Drivers were intercepted for a 24-hour period at each of 10 locations, and for a 16-hour period at three other locations. Ordinarily such locations are close to cities where through traffic mingles with that shuttling back and forth in and out of town. This procedure assures that little traffic escapes; it makes for completeness and certainty in the results of a study. But in the present case such a procedure was not considered warranted. For one

thing it was doubtful if time would have permitted; for another, experience has shown that a great proportion of trips are exceedingly short. It was considered likely that few short trips in the mid-state area would be in a position to take advantage of any route that could be proposed, or that they would involve sufficient vehicle miles to materially affect the results of the study. It was therefore decided to cull out as many short trips as possible at an early stage of the work.

Accordingly, interview stations were located remote from instead of close to the cities, yet in such manner that few trips of interest would evade notice. The information that was obtained, therefore, pertains to the "longer" trips in the mid-state area; to their origins and destinations, and to their direction of travel and length. All these components of a trip have been taken into account in preparing a Chart of Trip Desire, Plate 4. It shows what the traffic flow would be if there were no obstacles. As this type of chart is rather uncommon, an explanatory note on its construction will aid in showing its use.

The course of each of the 79,000 longer-distance auto and truck trips occurring on an average week day in the summer of 1950, has been traced from beginning to end in a straight line, and caused to leave its track across the map. This was accomplished by superimposing a grid on the State map; its interval was 10 miles, and every origin and destination was referenced to it. As each trip proceeded toward its destination,

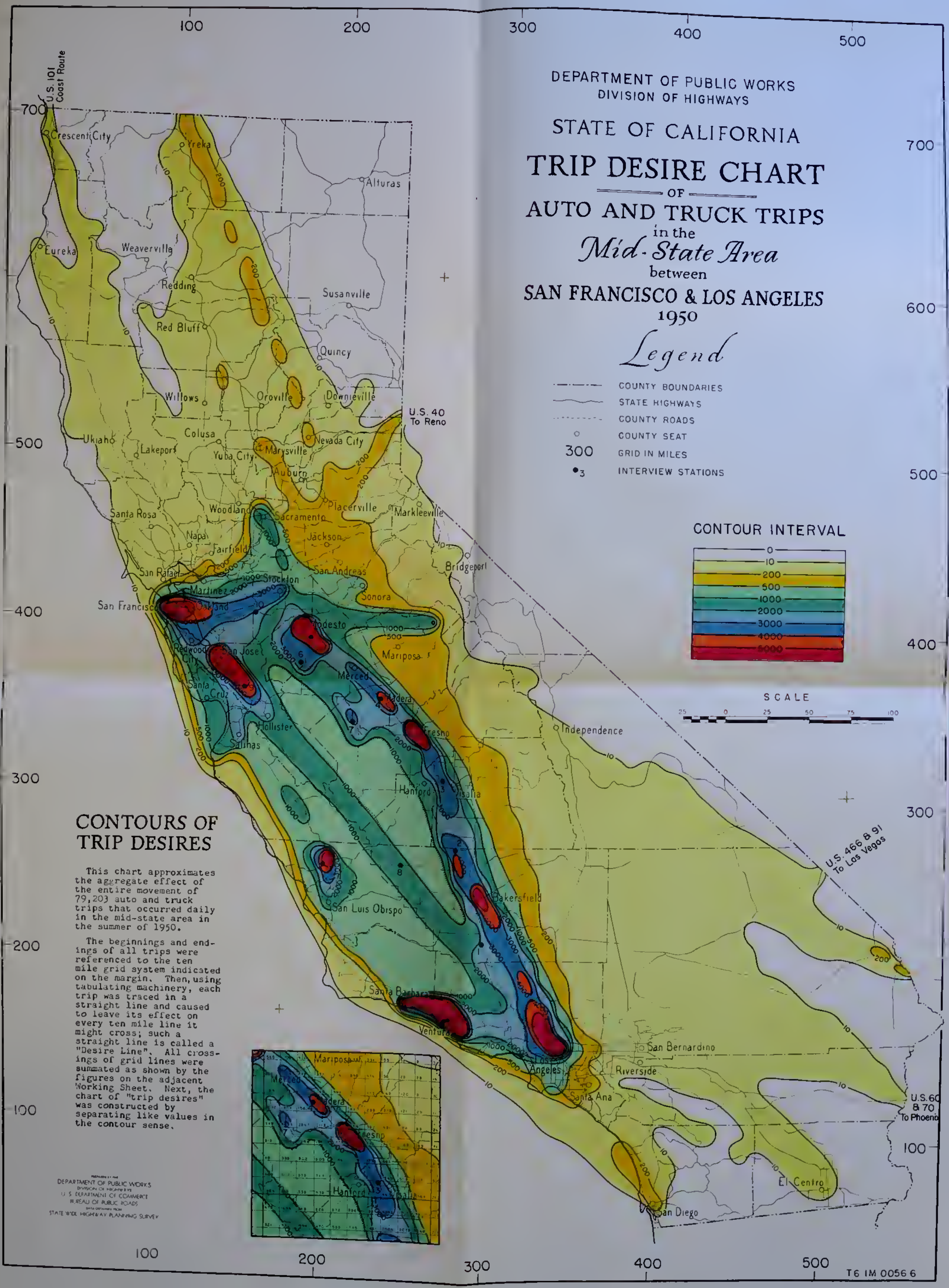
TRIP DESIRE CHART

PLATE 4

14

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STATE OF CALIFORNIA
TRIP DESIRE CHART
OF
AUTO AND TRUCK TRIPS
in the
Mid-State Area
between
SAN FRANCISCO & LOS ANGELES
1950



CONTOURS OF TRIP DESIRES

This chart approximates the aggregate effect of the entire movement of 79,203 auto and truck trips that occurred daily in the mid-state area in the summer of 1950.

The beginnings and endings of all trips were referenced to the ten mile grid system indicated on the margin. Then, using tabulating machinery, each trip was traced in a straight line and caused to leave its effect on every ten mile line it might cross; such a straight line is called a "Desire Line". All crossings of grid lines were summated as shown by the figures on the adjacent Working Sheet. Next, the chart of "trip desires" was constructed by separating like values in the contour sense.

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DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
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STATE WIDE HIGHWAY PLANNING SURVEY

its position was noted every time it crossed a grid line. A minor adjustment was then made, each of the crossings of the grid line being credited to the closest coordinate point. By summating trips at all such points, their "traffic elevations" were obtained. The final step consisted of selecting suitable contour intervals and drawing the contour lines.

The shapes of the limiting contour lines give a picture of the general traffic desire in the mid-state area. Looking at Plate 4, attention is immediately attracted to a series of ridges, upon some of which peaks are superimposed. The long axis of a ridge indicates the direction in which a preponderant majority of vehicles wish to move, and the peaks indicate either centers of traffic concentration or intersecting streams of traffic.

The most prominent ridge on the map is that running from Los Angeles to Fresno, and then northwesterly towards San Francisco. Note the concentration of peaks on this ridge at Bakersfield, Fresno, Modesto, etc., on State Highway Route 4.

There is a lower ridge running directly from Los Angeles to San Francisco Bay Area; it is not closely related to any existing route. It shows that the through traffic between the two areas is from 1,000 to 2,000 vehicles daily. (By reverting to the original material from which the map was prepared it was found that traffic from the Bay Area and points north to Los Angeles and points south was 1,757 daily, or 2,024 if San Jose is included.) On this ridge the only intermediate peak between the termini is at San Jose; there is little local traffic along this alignment.

The observation, that traffic on both these ridges runs in a northerly direction, prompts another: the map does not show any strong east and west traffic desire throughout the greater part of the area. While there are, of course, many east and west trips they are in effect overwhelmed by the predominant north and south flow of traffic, with few exceptions. One exception is the ridge that has its origin in the Bay Area and juts out into Yosemite; another reaches to Stockton and continues, although diminished, to the Nevada State Line.

The ridges that reach out to the boundaries of the State merit a brief note. The long axes of those reaching to San Diego, El Centro, Blythe, Needles, and Yreka intersect within about 25 miles of Fresno. In the case of the Yreka ridge, a series of small peaks extends southeasterly to Nevada City. They are also on a straight line with Fresno and Los Angeles and give a glimpse of the part that both cities play in the traffic crossing the Oregon border. None of these ridges represents a heavy flow of traffic, but taken together they indicate roughly the importance of Fresno as a focal point for traffic in the San Joaquin Valley.

So, from examination of the map, it is possible to set up tentative conclusions of a broad nature, which must be put to further tests. The map suggests that:

(1) The greatest number of trips would be served by a route lying east instead of west of the Diablo and Temblor Ranges, because the traffic ridge running

along State Highway Route 4 has no counterpart west of the mountains;

(2) In all probability the greatest volume of trips could be developed by a route west of and closely parallel to existing Route 4;

(3) Any route in the San Joaquin Valley would in its northern reaches, in the Altamont Pass, receive important increments of traffic coming easterly from Yosemite, and northeasterly from Stockton and points beyond. No such traffic increments would accrue to a route through Pacheco Pass (Route C_1).

What the indicated service would amount to in terms of vehicle miles is approximated by a more detailed study of the 79,000 trips whose paths were traced on the Trip Desire Chart. These trips, it will be recalled, are the longer-distance trips. Their average length was approximately 80 miles air-line distance; half of them were less than 50 miles (Table 3). A trip as it is defined in this study is a movement from place to place, uninterrupted by stops except for fuel or meals.

Assignment of Traffic

It is undesirable to burden this report with detail on the manner in which traffic was assigned to the several routes, but it is essential to outline the general method, because, in the light of present knowledge, the assignment cannot be entirely objective. However, it is possible to arrange the facts so as to show the stages at which individual interpretation was necessary.

TABLE 3

DISTRIBUTION OF STRAIGHT LINE TRIP LENGTHS

Length of Trip in Miles	NUMBER OF TRIPS	Percent of Total Trips	Cumulative
	Autos & Trucks		
Less than 10	4598	5.8	5.8
10	18743	23.7	29.5
20	5518	6.9	36.4
30	4641	5.9	42.3
40	6182	7.8	50.1
50	2875	3.6	53.7
60	3787	4.8	58.5
70	2569	3.3	61.8
80	2845	3.5	65.3
90	4500	5.7	71.0
100	3219	4.1	75.1
110	1310	1.6	76.7
120	1481	1.9	78.6
130	1106	1.4	80.0
140	1473	1.8	81.8
150	900	1.2	83.0
160	1410	1.7	84.7
170	1630	2.1	86.8
180	925	1.2	88.0
190	656	.8	88.8
200	1171	1.5	90.3
210	406	.5	90.8
220	497	.7	91.5
230	326	.4	91.9
240	219	.3	92.2
250	290	.3	92.5
260	316	.4	92.9
270	620	.8	93.7
280	202	.3	94.0
290	245	.3	94.3
300	361	.4	94.7
310	205	.3	95.0
320 & over	3977	5.0	100.0
TOTAL	79,203		

The entire State was divided into 38 zones, some of great area others small, depending on their relationship to traffic of the mid-state area. A traffic center was determined for each; Newman, Fresno, and Taft are typical examples. Interchanges of trips between zones were then routed between the traffic centers. Routing was confined with few exceptions to State Highways. Trips were then assigned to each of the four study routes on two bases: (a) distance; (b) time. Under the first criterion the trip distance obtained by using each of the four study routes was compared with the shortest distance using existing routes. As will appear, the traffic assignment under this procedure is considered as the estimated minimum.

The procedure was very much the same where time was the criterion, but in this case one assumption was made: an "advantage ratio" of 1.2 to 1 was assumed. This is another way of saying that all things considered, a new facility would represent a net improvement of 20 percent over a competing existing route. At first glance the ratio of 1.2 to 1 may seem too low, and some explanation is required of its derivation. The "advantage ratio" includes a multitude of factors. Some, like time or speed, are readily measurable. Others, like the safety element, economy of vehicle operation, comfort and convenience, the freedom to exercise a choice of speed, are only measured with difficulty, if at all. Nevertheless, these latter elements may conceivably exert as great an influence on a motorist's choice of route as does the more easily determined element of time saving. Thus, even though they are immeasurable, and

perforce the "advantage ratio" is based substantially on speed, it is essential to recognize and to make some allowance for them.

Speed tests, from time to time, have shown the average speed of the stream of traffic to approximate 50 mph (or slightly less) in valley and easy rolling country. This speed has been assumed on all existing roads over which trips were routed. While it is, of course, true that 50 mph cannot be averaged on some sections of existing highway in the mid-state area, it is equally true that still greater speeds can be obtained on others. Further, adoption of a speed a mile or two either below or above 50 mph would not greatly affect the results of the traffic assignment. For this reason and in view of other unmeasured factors, attempt at further refinement seems unwarranted.

One of these unknown factors has to do with the speed that could be had on a freeway or expressway; 60 mph has been assumed although there is currently no compelling evidence in California of average speeds much above 55 mph. An allowance of 60 mph tacitly recognizes the possibility that speeds on freeway sections may well increase as the mileage of such roads is extended. It may, too, be considered as including an allowance for the intangible factors encompassed by the "advantage ratio". So, in determining which of several routes is the best on the basis of time, portions of a trip on existing highways have been taken at 50 mph, and portions on the routes under study at 60 mph.

Another point about the "advantage ratio" is also noted. As a new road takes up the flow of traffic, the old is correspondingly relieved; what may have seemed intolerable congestion vanishes and the old road becomes once again attractive. So the "advantage ratio" that at first might seem to have been 2 to 1, for example, declines as traffic equilibrium comes about between new and old.

The manner in which the traffic assignment procedure works can be illustrated by taking for an example a trip from Modesto to Santa Barbara. The shortest distance is along the west side of the San Joaquin Valley, then through Cholame via State Highway 33 to San Luis Obispo, and south to Santa Barbara. This trip would not be assigned to any portion of Route A on a distance basis. But it would be assigned on a time basis for the fastest route would be through the Pacheco Pass, intercepting Route A west of Hollister; thence south on Route A to San Miguel; and finally along existing Route 2 to Santa Barbara. Such a trip would require 8 miles of additional travel, and it would save 10 minutes in a total distance of 318 miles. Were Route C under study, the trip would be assigned to it; 6 miles and 28 minutes would be saved from what is presently required. As to Route D, 74 miles of it could be utilized and a saving made of 4 miles and 19 minutes.

All of the 79,000 trips in the mid-state area have been tested like this one from Modesto to Santa Barbara. Those that could save time or distance in comparison with their performance on existing routes have been assigned to the routes

under study, such routes being considered one at a time; and the trips so assigned comprise the maximum potential traffic. This maximum potential includes trips that might travel either a part or all of the distance from Wheeler Ridge to San Francisco. When considering these trips to find some rule for reducing their numbers, for the purpose of getting at the probable traffic that might be expected, several questions arise.

One question involves the relative weights to be applied to the factors of distance and time: Is a saving in distance worth more or less than one of time? Another has to do with distance alone: How great does the fractional saving of a trip have to be before it passes from a mere trifle into the realm of consequence? Similar questions evolve about time.

Questions of this kind are not in any sense new, but they grow increasingly important as the traffic flow increases and becomes more complicated, and as the road systems are expanded so that one road begins to compete with another. There are no precise answers to them, and, indeed, very little information assembled that would permit categorical answers if they could be given. But at least what information there is can be arranged roughly in order, so that it is possible to work up the scale from the unreasonable to the reasonable. This is the purpose of Tables 4 and 5. They summarize what facts are presently available about the maximum potential traffic.

Approximately one out of every four trips in the daily flow of 79,000 trips is considered a possible user of

TABLE 4

Trip Lengths on Routes Studied Between Wheeler Ridge and San Francisco. Portions of Trips That Would Use Existing Routes Are Excluded.

Length in Miles	No. of Trips Using Some Portion of Route			
	Route A	Route C	Route C_1	Route D
0-9	2254	219	2260	25
10-19	4336	2600	2008	3151
20-29	1971	596	3052	84
30-39	398	877	275	2027
40-49	572	362	852	2824
50-59	463	2455	1053	2328
60-69	666	3833	2737	1848
70-79	656	1923	190	2480
80-89	1000	104	41	1408
90-99	469	711	799	131
100-109	2074	55	553	398
110-119		172	906	2221
120-129		8		44
130-139	70	172	403	175
140-149	264	192	36	392
150-159	285	7	14	
160-169		38	142	1503
170-179	21	61	45	28
180-189	487	815	1638	398
190-199	56	242	2	128
200-209	272	69	31	1570
210-219		13	52	35
220-229	454	1173	16	16
230-239	145	25	339	25
240-249		204	126	80
250-259	158	203	346	36
260-269			70	178
270-279	93	146	76	366
280-289				
290-299	673	603	1722	621
300-309	1195	1119		1175
Total	19032	18997	19784	25695
Veh. Miles	1,622,613	1,921,062	1,818,047	2,561,716
Average Length on Facility *	85.26	101.12	91.89	99.70

SOURCE: Tab. 9054
RDB:ljb 12/13/50

* Calculated from ungrouped data

TABLE 5

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

MAXIMUM POTENTIAL LOSSES - VEHICLE MILES AND TIME

Time Saved Minutes	Time			
	Number of Trips			
	Route A	Route C	Route C1	Route D
0 - 1	5446	2846	4938	2738
2 - 3	2711	346	1842	641
4 - 5	841	999	911	1788
6 - 7	37	1568	535	5224
8 - 9	102	864	99	901
10 - 11	1480	402	1052	326
12 - 13	330	2150	2153	2948
14 - 15	884	162	845	229
16 - 17	256	1697	1053	1104
18 - 19	192	1681	79	871
20 - 21	-	96	70	124
22 - 23	1198	1022	1021	1758
24 - 25	512	86	178	362
26 - 27	117	434	510	116
28 - 29	226	66	264	218
30 - 31	342	209	1064	239
32 - 33	149	64	57	510
34 - 35	20	164	18	574
36 - 37	59	204	61	519
38 - 39	909	42	23	384
40 - 41	1	1110	101	166
42 - 43	-	11	66	193
44 - 45	339	23	127	137
46 - 47	165	5	103	47
48 - 49	63	245	21	1272
50 - 51	-	70	101	1
52 - 53	18	110	184	30
54 - 55	-	476	86	77
56 - 57	-	21	-	16
58 - 59	187	18	3	38
60 - 61	300	7	14	-
62 - 63	192	83	-	83
64 - 65	146	2	494	171
66 - 67	46	114	-	293
Over 67	1764	1600	1711	1597
TOTAL	19,032	18,997	19,784	25,695

	Averages and Summary			
	Route A	Route C	Route C1	Route D
Maximum Potential Number of Trips	19,032	18,997	19,784	25,695
Number of Trips Breaking Even on Distance:	3,081	455	4,291	1,537
Vehicle Miles Saved	-	-	-	-
Time Saved (Minutes)	8,010	3,720	26,684	37,729
Average Time Saved per Trip (Minutes)	2.6	8.2	6.2	24.5
Number of Trips Saving Distance:	8,359	9,982	6,557	11,268
Vehicle Miles Saved	64,959	55,260	51,062	49,879
Average Vehicle Miles Saved Per Trip	7.8	5.5	7.8	4.4
Time Saved (Minutes)	313,645	292,717	256,405	391,507
Average Time Saved Per Trip (Minutes)	37.5	29.3	39.1	34.7
Number of Trips Losing Distance:	7,592	8,560	8,936	12,890
Vehicle Miles Lost	31,423	34,371	40,602	42,983
Average Vehicle Miles Lost Per Trip	4.1	4.0	4.5	3.3
Time Saved (Minutes)	41,672	112,063	91,932	89,171
Average Time Saved Per Trip(Minutes)	5.5	13.1	10.3	6.9
Net Vehicle Miles Saved	33,536	20,889	10,460	6,896
Avg. Vehicle Miles Saved Per Trip	1.8	1.1	0.5	0.3
Total Time Saved (Minutes)	363,327	408,500	375,021	518,407
Average Time Saved Per Trip	19.1	21.5	19.0	20.2

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TABLE 5

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

MAXIMUM POTENTIAL SAVINGS OR LOSSES -VEHICLE MILES AND TIME

	Miles	Distance Number of Trips Route A	Route C	Route C1	Route D
Distance Saved	29 & over		5		
	27 - 28			2	
	25 - 26	437		3	
	23 - 24		3		
	21 - 22		30		
	19 - 20		6	37	
	17 - 18		16	52	
	15 - 16	908	323	1818	
	13 - 14	300	1741	21	1594
	11 - 12	14	131	138	122
	9 - 10	1875	128	51	608
	7 - 8		451	1133	105
	5 - 6	2636	698	579	1347
	3 - 4	654	1211	1390	1207
	1 - 2	1343	2741	1119	6085
	0	3081	455	4291	1537
Distance Lost	1 - 2	3041	1608	4424	6527
	3 - 4	239	3255	748	4053
	5 - 6	451	451	1136	437
	7 - 8	128	308	1487	1327
	9 - 10	1247	116	444	142
	11 - 12	2	168	67	149
	13 - 14	10	202	284	94
	15 - 16	230	2		
	17 - 18	20	221	3	88
	19 - 20		66	257	
	21 - 22		99	139	7
	23 - 24	21	32	32	
	25 - 26	150	7	5	22
	27 - 28		5		
	29 & over	11			74
	TOTAL	19,032	18,997	19,784	25,695

Time Saved Minutes	Time Number of Trips Route A	Route C	Route C1	Route D
0 - 1	946	2846	4938	2738
2 - 3	2711	346	1842	641
4 - 5	641	999	911	1788
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22 - 23	1198	1022	1321	1758
24 - 25	512	86	178	362
26 - 27	117	434	510	116
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30 - 31	342	209	1064	239
32 - 33	149	64	57	510
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38 - 39	909	42	23	384
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66 - 67	46	114	-	293
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	Averages and Summary Route A	Route C	Route C1	Route D
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Vehicle Miles Saved	-	-	-	-
Time Saved (Minutes)	8,010	3,720	26,684	37,729
Average Time Saved per Trip (Minutes)	2.6	8.2	6.2	24.5
Number of Trips Saving Distance:	8,359	9,982	6,557	11,268
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Average Vehicle Miles Saved Per Trip	7.8	5.5	7.8	4.4
Time Saved (Minutes)	313,645	292,717	256,405	391,507
Average Time Saved Per Trip (Minutes)	37.5	29.3	39.1	34.7
Number of Trips Losing Distance:	7,592	8,560	8,936	12,890
Vehicle Miles Lost	31,423	34,371	40,602	42,983
Average Vehicle Miles Lost Per Trip	4.1	4.0	4.5	3.3
Time Saved (Minutes)	41,672	112,063	91,932	89,171
Average Time Saved Per Trip (Minutes)	5.5	13.1	10.3	6.9
Net Vehicle Miles Saved	33,536	20,889	10,460	6,896
Avg. Vehicle Miles Saved Per Trip	1.8	1.1	0.5	0.3
Total Time Saved (Minutes)	363,327	408,500	375,021	518,407
Average Time Saved Per Trip	19.1	21.5	19.0	20.2

Source: Tabulations #9071, 9053, 9067

RDB:emc
12-13-60

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some portion of Routes A, C, and C_1; on Route D the proportion is higher, one in three.

The average distance traveled along the several routes studied ranges from 85 miles on Route A to 101 miles on Route C. This is a small range. One contributory reason may be that the proportion of long distance trips, 200 miles or over, is about the same on each route; the range is from 14.0 to 18.7 percent of the total vehicles on each route. In fact half of the long distance traffic would use the entire length of the facility. All of the latter group would be served advantageously by any of the routes to about the same degree.

It is noted however that the attraction of the routes for the short distance users is not as stable. For example, on Routes A and C_1, respectively, 44.9 and 37.0 percent of the trips that might be assigned would use less than 30 miles of either route; the corresponding figures for Routes C and D are 17.9 and 12.6 percent.

Net savings in vehicle miles would occur if any of the routes were built. The average saving per trip would range from 0.3 miles on Route D to 1.8 on Route A (Table 5). In highway location such savings are important for, other factors such as rise and fall of grade being equal, one of the foremost objectives is to save distance. The same objective would exist on a toll road, but it is apparent that savings in distance could not, in this case, be relied on as much of an enticement to traffic. For example, if running costs were at the extraordinarily high figure of 10 cents per mile and the toll rate at

1 cent per mile, the toll charge for an average trip of 85 miles on Route A would be almost five times as great as the saving.

All of the trips just discussed would save time, but not all would save distance. It is advisable to see what the situation would be if consideration were limited to that particular group in which all trips would save distance. For this group, the greatest average saving on any of the routes becomes 7.8 miles per trip and the average facility distance (Route A) 141 miles. Even in this case the toll charges would more than offset any saving that could be made in running costs. It seems clear that were any of the routes to be successful as a toll road, its attractiveness would lie not so much in distance saving as in some other factors such as saving of time, or comfort and convenience.

It will be recalled from the manner in which the maximum potential traffic was derived (by comparison with existing routes) that all trips would save time; many would save distance as well as time, others lose or break-even. The average time savings for each group are summarized below:

MAXIMUM POTENTIAL
AVERAGE TIME SAVED PER TRIP IN MINUTES

Route	Trips That Save Distance	Trips That Break Even	Trips That Lose Distance
A	37.5	2.6	5.5
C	29.3	8.2	13.1
C_1	39.1	6.2	10.3
D	34.7	24.5	6.9

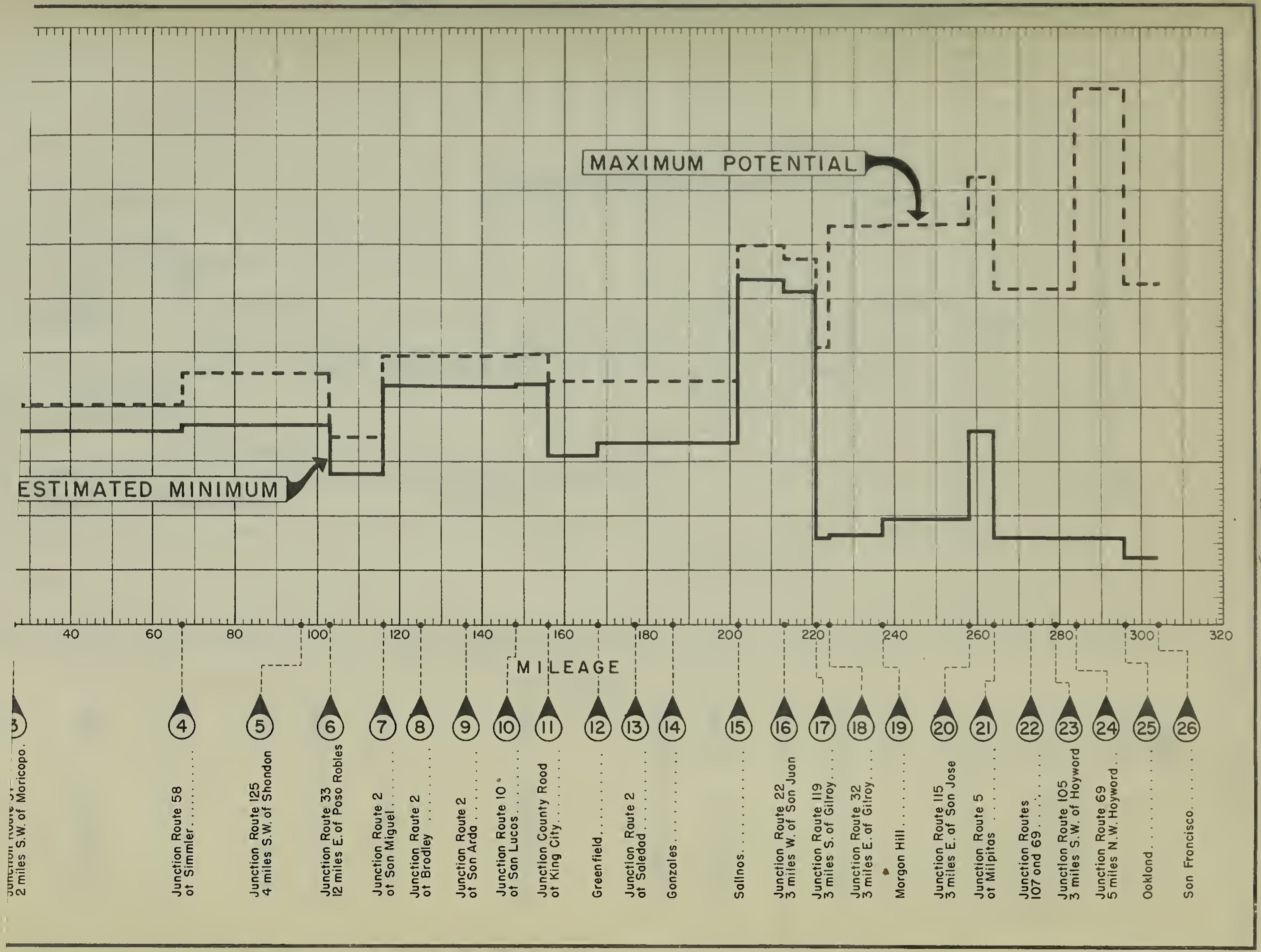
These would be worthwhile savings. A weeding out process designed to estimate probable traffic would increase the average time saved by each group. Such a process is implicit in the estimates of probable traffic that follow.

The traffic assignment of all the maximum potential trips is illustrated in Plates 5 to 8, inclusive. The zone to zone interchange of traffic from which these profiles were prepared is given in the Appendix. The data are also summarized in Table 6, where for convenience the traffic flow is now expressed in terms of equivalent through trips. These range from 8,539 vehicles daily on Route D downward to 5,338 on Route A. But it is unlikely that such traffic flows would materialize. Where traffic movements are complex, as in the present problem, it has been observed, in what few studies it has been possible to make, that the maximum potential estimates of traffic tend to be excessive. The reasons why this is so may only be surmized; experience is insufficient to permit their isolation in detail.

There are some drivers to whom distance is everything; they seek to save as much distance as possible, but in doing so fail to save as much time as possible. At the other extreme are those willing to sacrifice distance to obtain the greatest time saving; to them time is everything. A third group strikes a balance between these extremes; distance and time are saved, yet not the maximum possible of either.

Plate 5

TRAFFIC PROFILE
ROUTE Ⓐ as a toll-free road



TRAFFIC PROFILE
ROUTE Ⓐ as a toll-free road

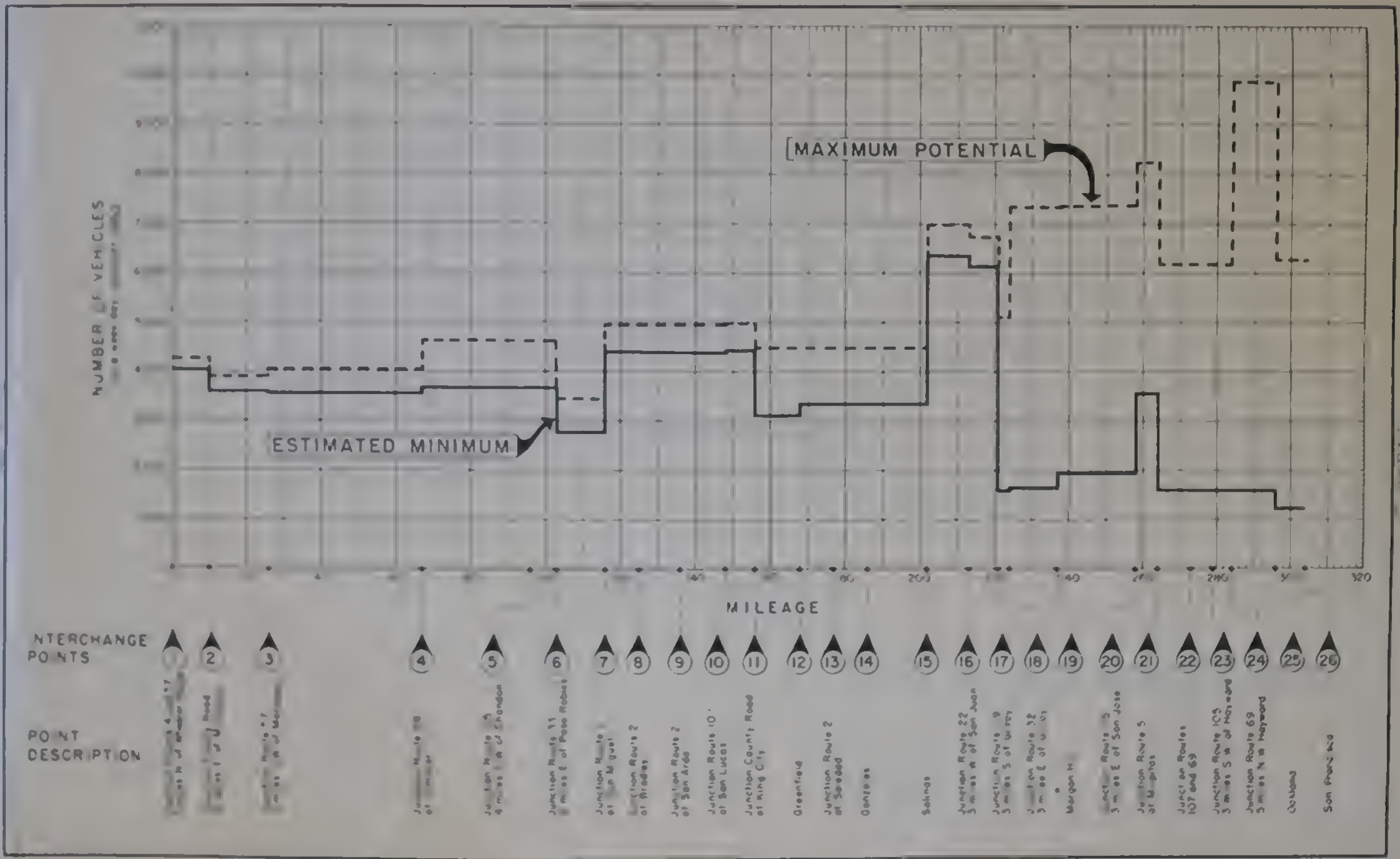
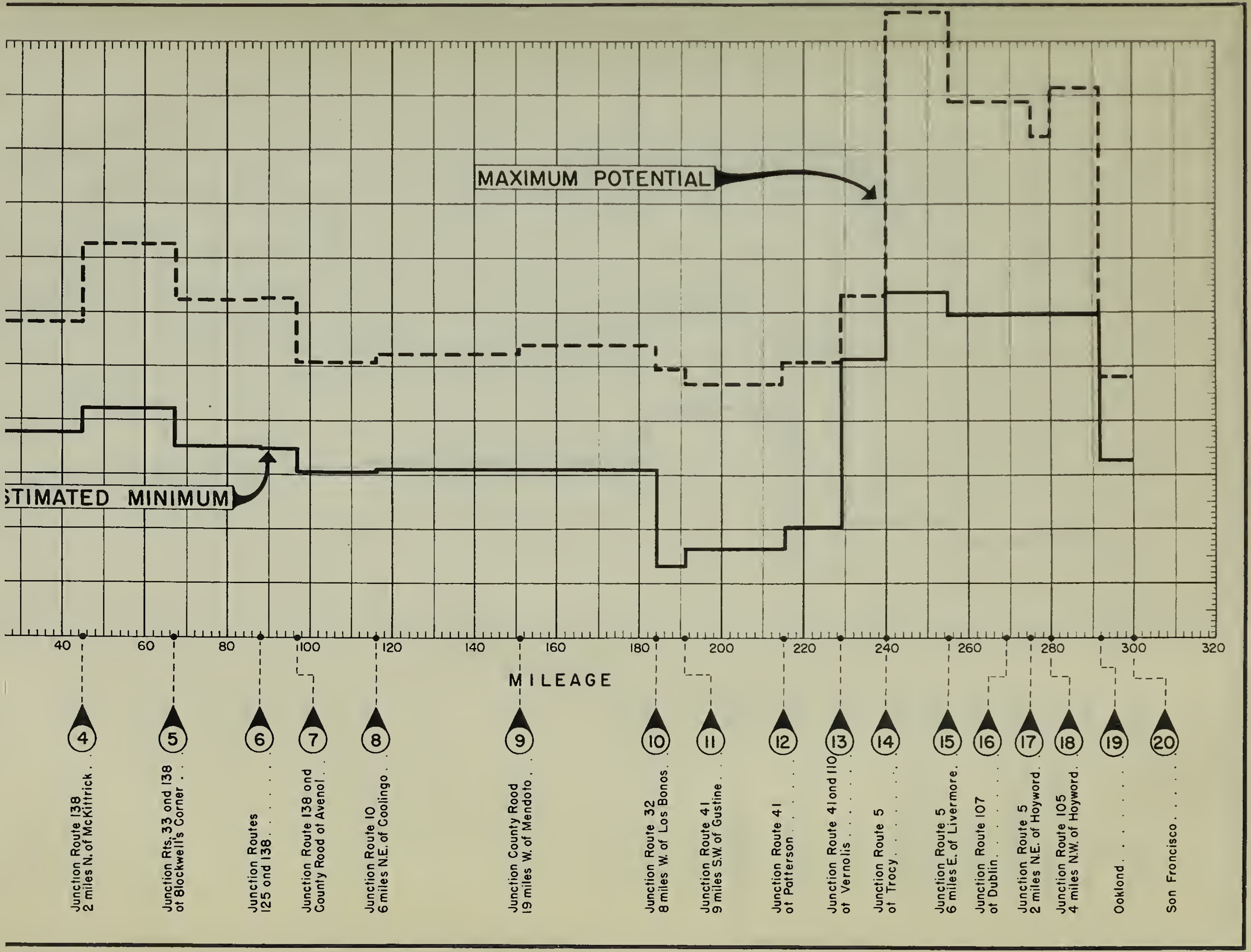


Plate 6

TRAFFIC PROFILE
ROUTE C as a toll-free road



TRAFFIC PROFILE
ROUTE Ⓒ as a toll-free road

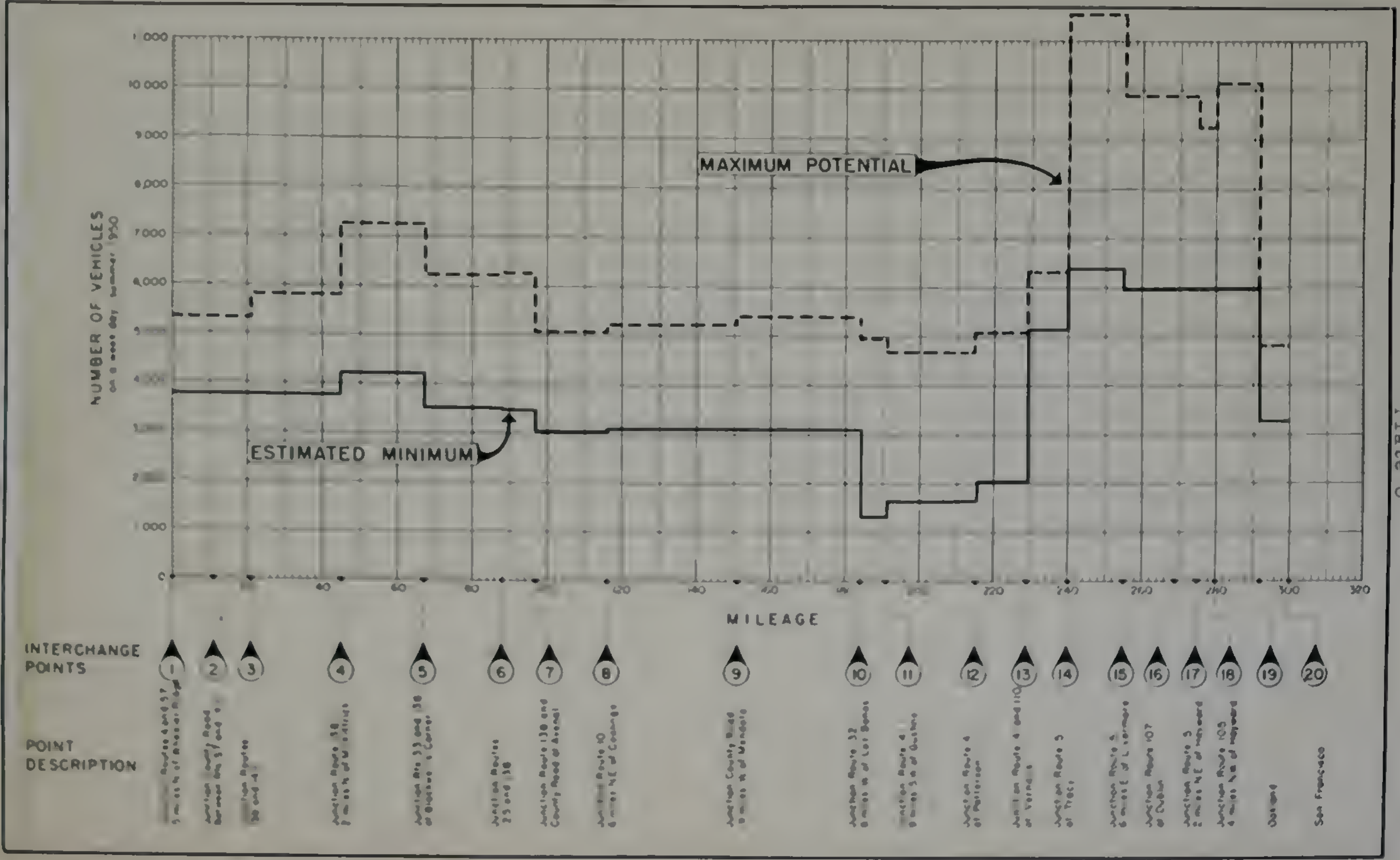
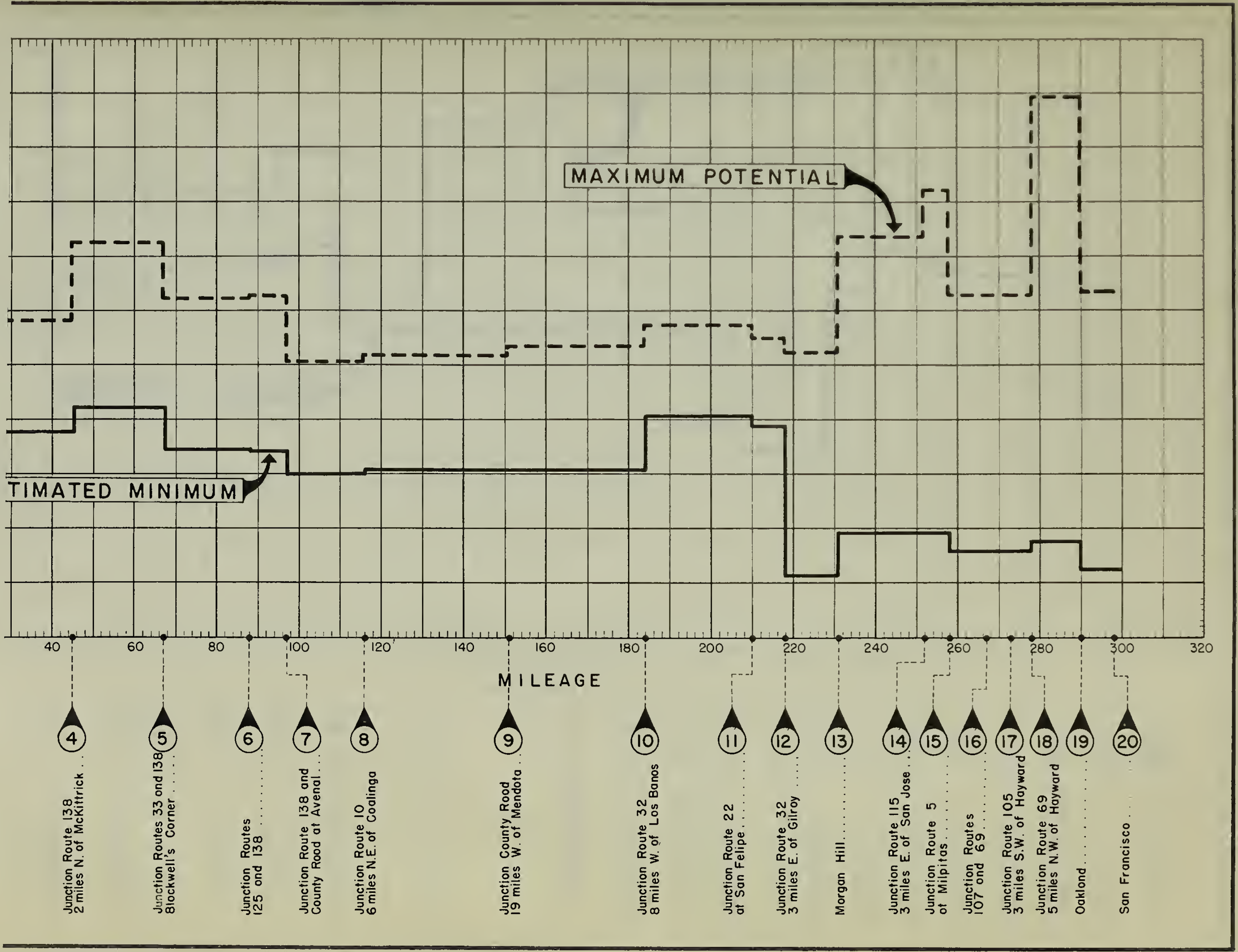


Plate 7

TRAFFIC PROFILE
ROUTE C_1 as a toll-free road



TRAFFIC PROFILE
ROUTE C1 as a toll-free road

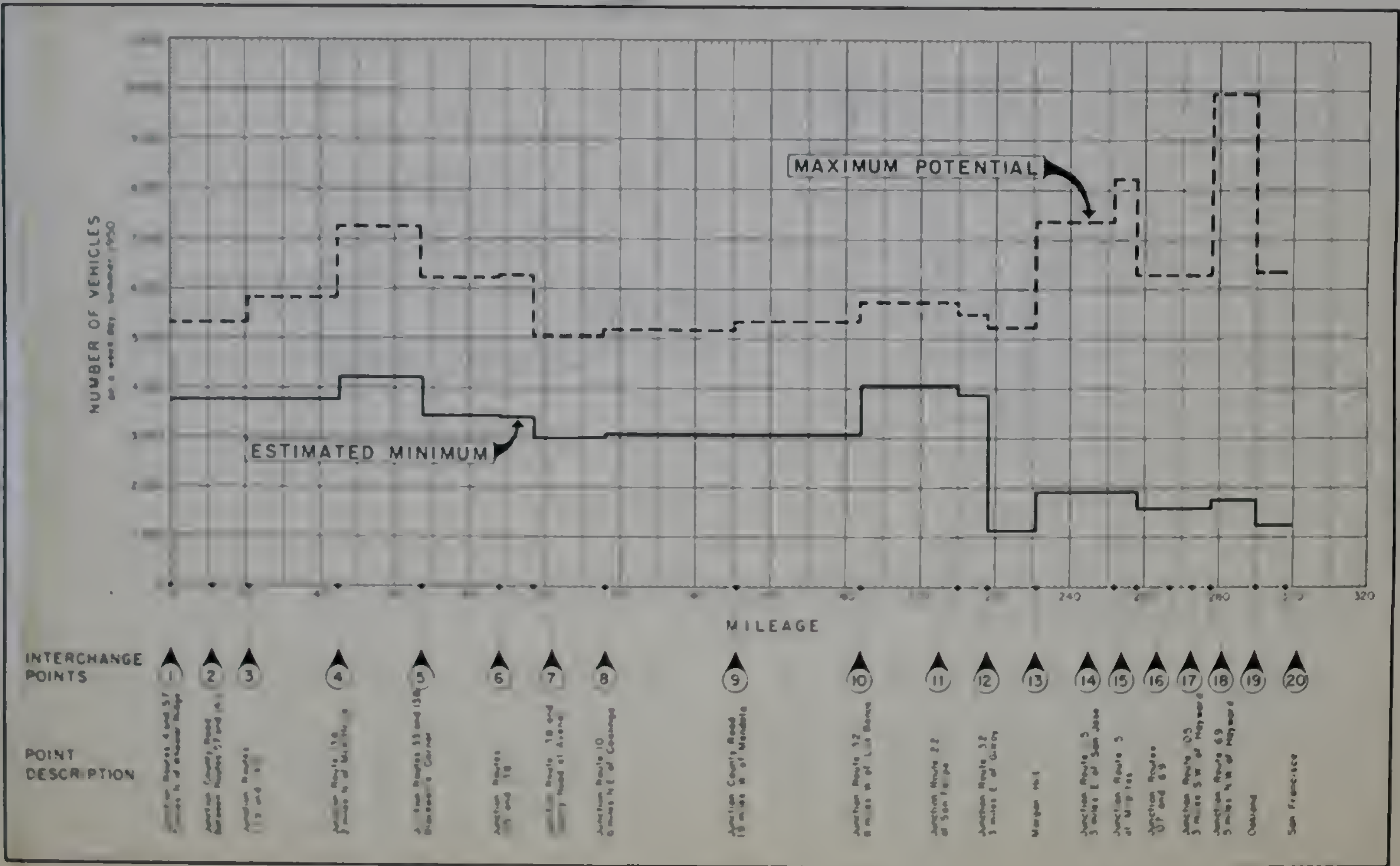


Plate 8

TRAFFIC PROFILE
ROUTE D as a toll-free road

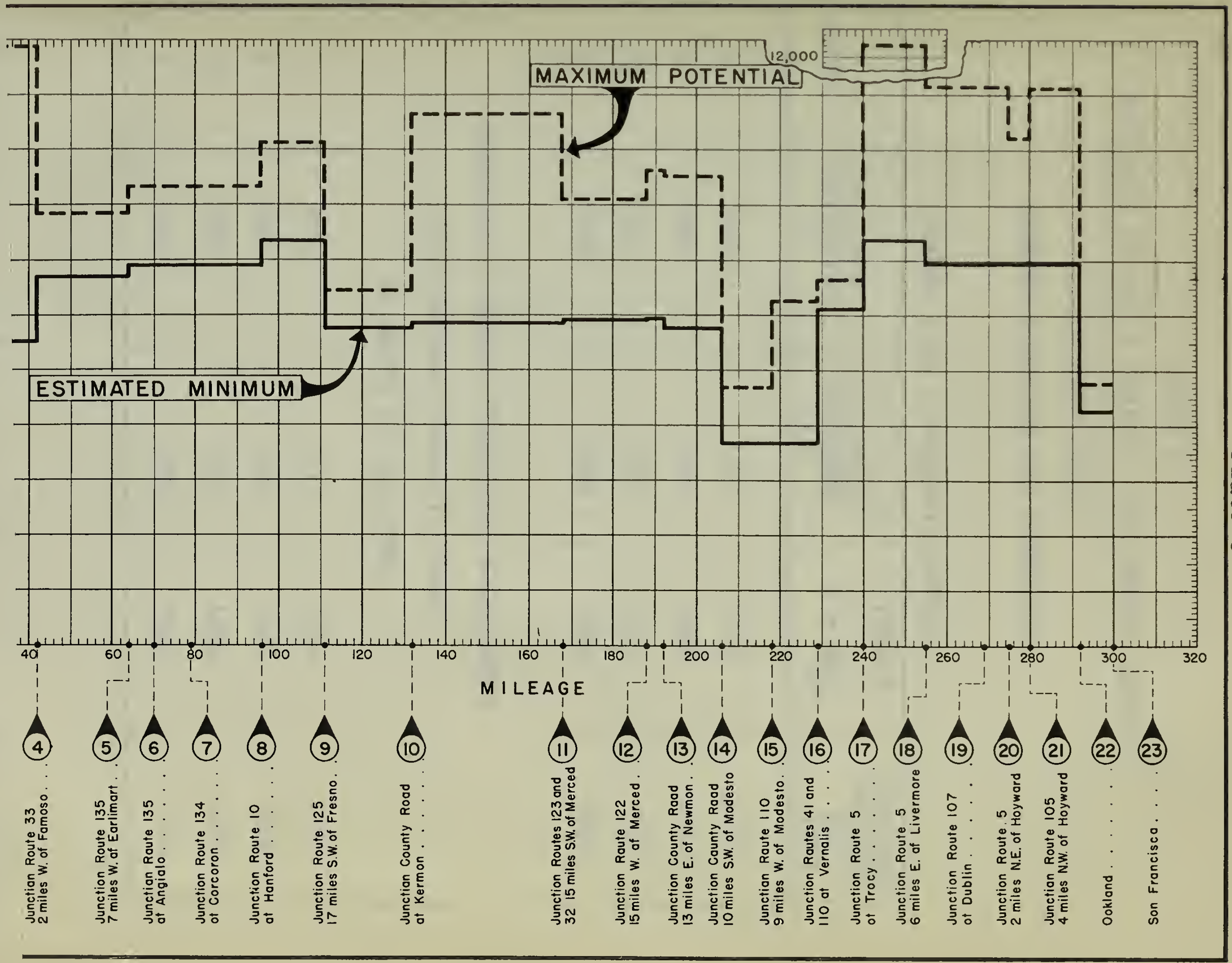


Plate 8

TRAFFIC PROFILE
ROUTE D as a toll-free road

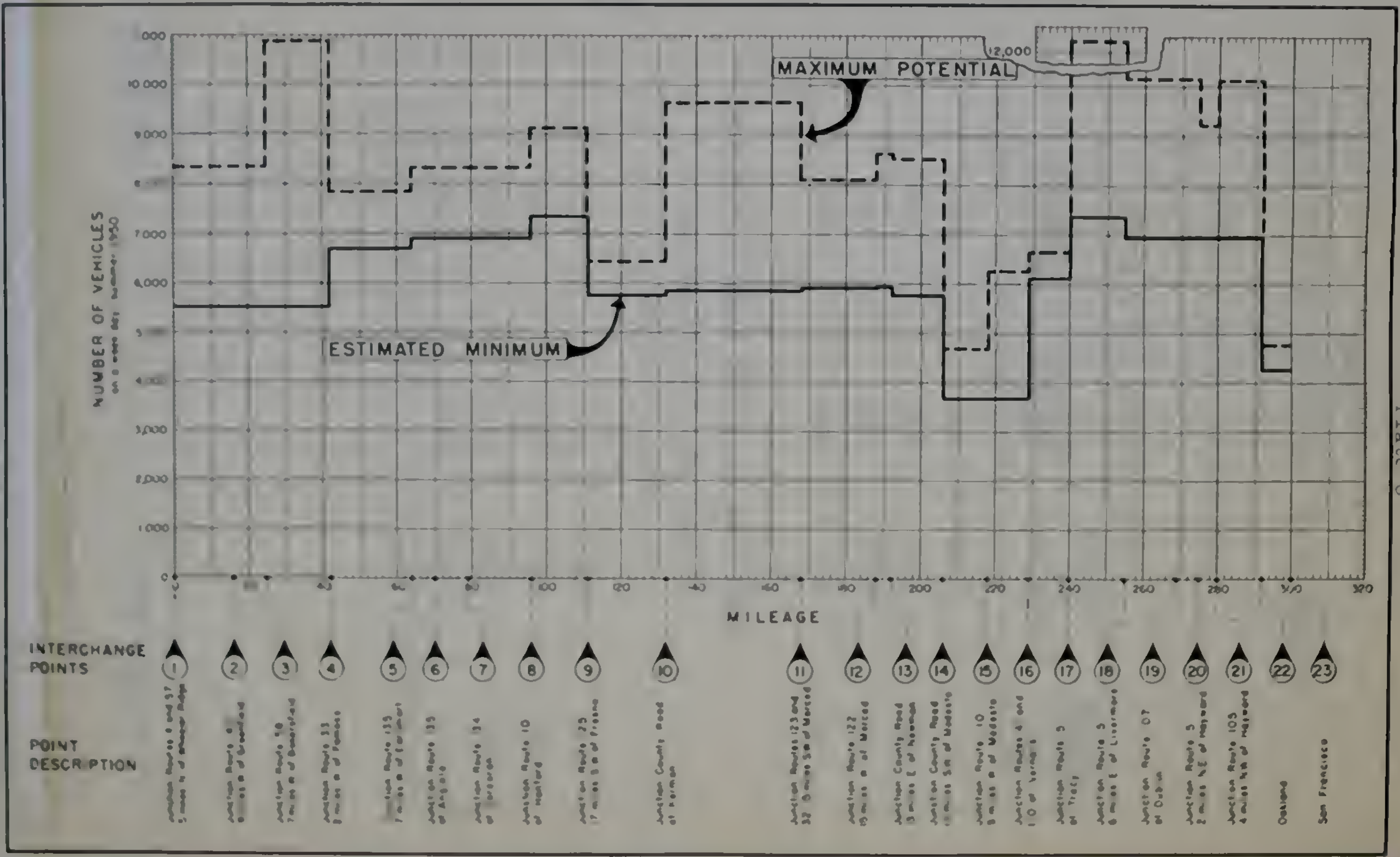


TABLE 6

ESTIMATE OF DAILY TRAFFIC OVER ENTIRE LENGTH OF EACH ROUTE

WHEELER RIDGE TO SAN FRANCISCO

SUMMER 1950 - WEEKDAY TRAFFIC

ROUTE	MAXIMUM POTENTIAL (a)	ESTIMATED MINIMUM (b)	AVERAGE $c = \frac{a+b}{2}$	AVERAGE WEEKDAY 1950 .877c
A	5338	3302	4320	3789
C	6404	3707	5056	4434
C_1	6101	3010	4555	3995
D	8539	6059	7299	6401

ESTIMATE OF DAILY TRAFFIC ON EACH ROUTE

FROM WHEELER RIDGE TO TRACY

OR NORTH OF SAN JOSE

A	5039	3572	4306	3776
C	5597	3205	4401	3860
C_1	5897	3311	4604	4038
D	8204	5880	7042	6176

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
[illegible]				
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The study has also disclosed a fourth group that is influenced less by time and distance than by other considerations.*
While it is easy to differentiate between these groups in a general way, it is not easy to say what particular weight should be given to each. The difficulty has been resolved arbitrarily by averaging maximum and minimum estimates of traffic in Table 6.

Now as far as traffic volume alone is concerned Route D is the best location, and it is followed in order by Route C_1, C, and A. The average daily traffic on the toll road portion of each route is:

Route	Average Daily Traffic	Trucks As Percent Of Total Traffic
D	6176	22.6
C_1	4038	21.0
C	3860	21.8
A	3776	19.8

---

* Of an estimated 2,000 terminal to terminal trips, a ratio of 2 to 1 used the longer Coast Route as against the Valley Route. It is not known if this ratio prevails throughout the year.

III

STANDARDS OF DESIGN AND COST OF CONSTRUCTION

Two considerations dictated the standards of design: (1) that a toll road to be successful must be on a high standard, a higher standard than is found on existing highways; (2) ingress and egress to the toll road must be such that payment of toll is inescapable. In short, a freeway would be required.

Typically, it would have a right-of-way width of 166 feet. Within this space there would be two 37 foot roadways and a 40 foot median dividing strip. Each roadway would consist of two 12 foot traffic lanes with an 8 foot shoulder on the right and a 5 foot shoulder on the left firm enough for emergency stopping and parking. Pavement would be of high type, and of a thickness consistent with the loads that might be expected -- 8 inch thickness on a firm foundation was assumed.

The road would be designed for the maximum uniform speed which probably would be adopted by the faster group of drivers, but not necessarily by the small percentage of reckless ones. Grades would seldom reach 3 percent and never exceed five. Horizontal and vertical curvature would provide not less than 600 feet of sight distance at any time. As a matter of fact sight distance would almost always exceed 2,000 feet because of the natural topography.

Opposing streams of traffic would be separated, with

major structures allowing for interchange of traffic at strategic points, and other structures separating completely either highway or railroad traffic. The average distance between traffic interchanges would range by routes from 12 miles on Route A to 17 miles on Route C. Bridges would conform to the general roadway development.

Cost of Construction

The costs of construction for each route under these general specifications are shown in Table 7 exclusive of toll collection facilities and interest during construction. They range upward from a total of $113,425,000 on Route C to $156,653,000 on Route A. Per mile, the cost is also lowest on Route C -- $473,000. These cost estimates are at current prices; no attempt has been made to foretell what costs might be at a future date. Nor has any provision been made for a reserve against either depreciation or obsolescence.

It will be noticed that these costs include no estimates for service stations, garages, restaurants, hotels, etc. It was taken that the main problem of the moment was in the revenue that would be produced directly by vehicles in motion and not by auxiliary facilities, which although possibly costly would necessarily be expected to earn enough or almost enough to pay operating costs and to amortize their capital costs. While such facilities would be essential to the success of a toll road they would hardly be a controlling element.

TABLE 7

ESTIMATED COST OF CONSTRUCTION
(Based on Prices for 1950)

	ROUTE A	ROUTE C	ROUTE C_1	ROUTE D
Right of Way	$ 10,882,000	$ 4,961,000	$ 7,051,000	$ 8,991,000
Roadway and Surface	108,350,000	85,803,000	97,450,000	86,350,000
Major Structures:				
Traffic Interchanges	10,500,000	6,000,000	7,400,000	7,500,000
Road Separations	5,900,000	5,150,000	4,850,000	9,400,000
Railroad Separations	5,100,000	1,200,000	2,100,000	5,100,000
Streams	1,680,000	-	-	6,500,000
Net Roadway Construction	142,412,000	103,114,000	118,851,000	123,841,000
Engineering and Contingencies	14,241,000	10,311,000	11,885,000	12,384,000
Total Roadway Construction, Engineering and Contingencies	156,653,000	113,425,000	130,736,000	136,225,000
Toll Booth Construction	657,000	440,000	473,000	537,000
Engineering at Toll Booth Construction	66,000	44,000	47,000	54,000
Total Construction and Engineering	157,376,000	113,909,000	131,256,000	136,816,000
Interest During Construction for 3 years at 3¼% per annum	15,344,000	11,106,000	12,797,000	13,340,000
Total Construction Cost to be Amortized	$ 172,720,000	$ 125,015,000	$ 144,053,000	$ 150,156,000
Miles	264	240	258	240
Cost per Mile Exclusive of Cost of Toll Booths and Interest During Construction	593,000	473,000	507,000	567,000

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Maintenance Costs

The average annual cost per mile for maintenance of rural State Highways approximates $1,250. However, costs on the more heavily traveled truck routes tend to exceed the average; for instance, the cost for State Highway Route 4 in the San Joaquin Valley approximates $1,595. For present purposes, then, maintenance has been set at $2,000 per mile for a toll road, in an attempt to anticipate the greater costs that would be encountered for several reasons. For one, a toll road would be of greater width and have more lanes than would ordinarily be found on the average State Highway to which the lower costs above pertain. Further, maintenance would be unavoidably inefficient because the maintenance territories on the toll road would be long and narrow -- in sharp contrast with the normal area; on a toll road, travel from a central point could only be possible in two directions, whereas, on the State Highway System, many roads are reached with a minimum of travel from an easily accessible central point. Too, use of equipment would be less efficient; much idle time might be anticipated.

Toll Collection and Administration

Many of the interchanges would be at isolated locations handling minimum traffic volumes and, therefore, warrant one collector only on duty. As a practical matter, however, two should always be present. A minimum interchange having only one booth requiring one collector on duty per shift would be in charge of a sergeant, who would normally be present during the day shift. As volume of traffic in-

creased and additional collectors become necessary, a senior collector would function as supervisor on the other two shifts for a plaza requiring two to four collectors; for a plaza requiring more than four collectors on duty at all times, a sergeant would be present. A toll captain would have overall supervision of a major interchange, or a number of smaller interchanges in, say, a territory not exceeding 75 miles in length. Revenue collections would be made by an armored car detail at appropriate intervals, and all bookkeeping and auditing would be done at a centrally located District Office.

In accordance with these requirements, and they are not elaborate, it is estimated that the cost of operation per interchange would approximate $33,000 per annum. Additionally it is estimated that the administration and accounting for a toll road would cost approximately $250,000 per annum. No allowance has been made in these estimates for any kind of special police force.

IV

COMPARISON OF REVENUE AND COSTS

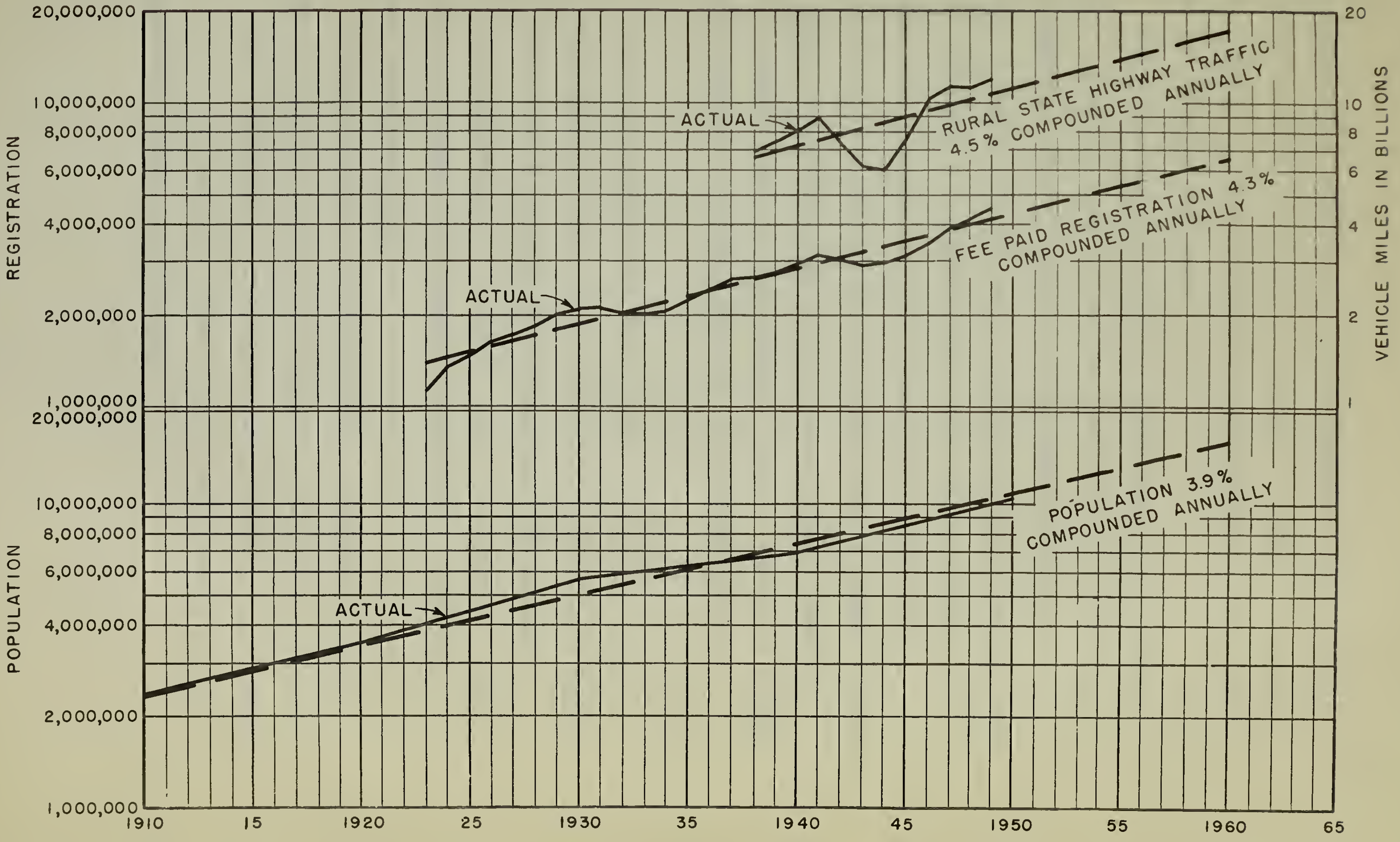
Before revenue and costs can be compared, three assumptions must be set up. The first pertains to the traffic increase that will occur over a period of 20 or 30 years; the second to the toll rates on which annual earnings would be dependent; the third relates to bond issues.

Three series of data are relied on in anticipating traffic increase: vehicle miles on rural State Highways; fee paid motor vehicle registrations; and population. They are interdependent.

The series showing population growth has the longest history. Amongst those whose business it is to predict population trends there is fair agreement that the annual rate of increase is constant in a young country, but tends gradually to decline and level off as the country becomes more settled and developed. Plate 9 illustrates the first phase; it shows what has happened in California for the past 50 years. The population has compounded at 3.9 percent annually; this rate has been substantially so for 100 years and has been called "venerable".

The difficult point to estimate now is whether the turning point in the rate of growth will be reached in the next two or three decades and, if so, when. Although opinions have been expressed that the trend which has prevailed so long in California will not continue, they are not supported

PLATE 9
Growth Trends



by very convincing evidence, and consequently there is not much ground to predict either no change or a decline in the rate of growth. In this study it is assumed the rate will continue but not be exceeded.

This speculation which is based upon past experience over a long term of years has been influenced by two other thoughts. First, that the processes of change over a long term of years are not well understood; there seems to be a natural tendency to underestimate the future effects of scientific developments and their manifold applications. Second, it is noted that there are areas less endowed with resources than California that support much greater populations. An annual rate of 3.9 percent then is taken as being within the bounds of possibility; it is considered the maximum.

Now it is noted that the growth trends for motor vehicle registrations and vehicle miles on rural State Highways are considerably greater than those for population; they are, respectively, 4.3 percent and 4.5 percent. Their spread indicates that our economy is relying increasingly on highway transportation.

For the purposes of this study a compound rate of 4 percent is assumed, and it is applied to the average daily traffic shown in Table 6 for each route. In sum, the effect of this rate is an estimate that traffic will double itself in 20 years and triple in 30 years.

Toll Rates

The second assumption has to do with the toll rates on which annual earnings would be dependent. The crux of the problem is to charge what the traffic will bear and not charge what it will not bear. In this dilemma California's experience with toll bridges is of no help; there is little competition between them, and their rates may be set so as to yield the highest net return. Their tolls are based on near monopoly conditions that would not exist on any of the routes studied.

Reference is therefore made to the toll rates prevailing on the Pennsylvania and Maine Turnpikes, the only long toll roads now in operation.

The rates on the Pennsylvania Turnpike average 1 cent per vehicle mile for autos and 4 cents for trucks; currently the average for the stream of traffic is 1.76 cents. This is an especially favored facility in that there are no alternate free highways between its termini with comparable grades -- the maximum is 3 percent -- and of modern cross section and alignment.

It is concluded that the Pennsylvania Turnpike is especially attractive to truck traffic on account of the advantage of the low rate of grade as compared with alternate free highways. In 1941 trucks and busses constituted 12 percent of the traffic stream. In the post war years the percentage rose from 18 in 1946 to 23 in 1949.

None of the facilities studied in California would be in as favorable a position as the original Pennsylvania Turnpike which was 160 miles in length; none would bring about any appreciable savings in cost by a reduction of grades. In fact all of the routes would be subject to the strong competition, more in some cases than others, of free highways. Although it is considered unlikely that the Pennsylvania rates could be charged, they have been cited for comparative purposes.

The Maine Turnpike, on the other hand, constructed from Kittery at the New Hampshire State Line to South Portland, presents a case of a route where the conditions are more nearly parallel to those found in this study. The Maine toll road is roughly parallel with US 1 along the coast and the distances are approximately the same on both routes. Grades are moderate, with a slight advantage in favor of US 1.

It is not surprising, therefore, to find that the truck rates on the Maine Turnpike are less than those in Pennsylvania; currently they seem to be about 1-1/3 cents for autos and 2 cents for trucks. They were raised to their present figures on May 1, 1949. Rates akin to these would seem much more appropriate in the present study and, therefore, 1 cent for autos and 2 cents for trucks will be used in estimating financial feasibility. Truck traffic in this study was found to approximate 22 percent of the total. Under the rates assumed, then, the composite rate for the entire stream of traffic would be 1.22 cents per vehicle mile.

Bond Terms

An interest rate of 3-1/4 percent annually has been assumed as fairly representative of what is being paid on bonds issued to build untested projects. (See Table 8) It is, of course, much higher than it would be were the credit of the State pledged; in California a recent issue of state general obligation bonds bears an average rate of 1.75 percent. The term of 30 years, as will be seen from Table 8, is common practice.

Revenue and Costs

The annual costs for amortization of bonds, maintenance, toll collection, and administration are given in Tables 9 to 12, inclusive. From these tables it can be seen that upon extinction of the debt, redemption would have accounted for approximately 51 percent of the total costs; interest, 35 percent; maintenance, 5 percent; and toll collection and administration, 9 percent.

Now taking the toll rate of 1.22 cents per vehicle mile, and assuming the improbable for the moment -- that all vehicles that would use the study routes as free roads would also use them as toll roads -- it is found that accumulated annual costs would exceed accumulated revenues for longer than 30 years on Route A; for 25 years on Routes C, C_1; and for 13 years on Route D. In other words, deficits would exist for these periods and have to be financed additionally.

TABLE 8

	Issued	Term	Interest Rate	Yield	Amount Issued
Maine	1946	30	2½		$ 15,000,000
	1947	29	2-3/4		5,000,000
Pennsylvania	1938	30	3-3/4	4.01 to 4.25	40,800,000
	1943	30	3-3/4	3.67	1,500,000
	1946*	30	2½	2.47	46,000,000
	1948*	20	2¼	2.41	47,000,000
Oklahoma	1950	40	3 to 4%	3.5+	31,000,000
New Jersey			3¼		245,000,000±

* The 1946 issue was a refinancing operation capitalizing earlier deficits and reducing interest rates. The 1948 issue was a refinancing operation to consolidate the obligations of the original section with the two extensions; $45,086,000 of the 1946 issue still outstanding is to be retired December 1, 1951 at $104.

TABLE 9

N FRANCISCO TOLL ROAD STUDY
D COSTS WITH ESTIMATED REVENUES
,TRONAGE BY ASSIGNED USERS

Route Ⓐ 264 MILES

Operation		Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
on	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
		$ 5,613,400	$ 5,613,400					
		5,613,400	11,226,800					
		5,613,400	16,840,200					
40	$ 250,000	10,529,340	27,369,540	4623	$ 7,394,840	$ 7,394,840	$ 5,434,762	$ 5,434,762
40	250,000	10,529,045	37,898,585	4808	7,690,761	15,085,601	5,652,246	11,087,008
40	250,000	10,529,078	48,427,663	5000	7,997,880	23,083,481	5,877,960	16,964,968
40	250,000	10,529,307	58,956,970	5200	8,317,795	31,401,276	6,113,078	23,078,046
40	250,000	10,528,605	69,485,575	5408	8,650,507	40,051,783	6,357,602	29,435,648
01	250,000	10,540,934	80,026,509	5625	8,997,615	49,049,398	6,612,705	36,048,353
01	250,000	10,541,008	90,567,517	5850	9,357,520	58,406,918	6,877,213	42,925,566
01	250,000	10,540,761	101,108,278	6084	9,731,820	68,138,738	7,152,302	50,077,868
01	250,000	10,541,061	111,649,339	6327	10,120,517	78,259,255	7,437,970	57,515,838
01	250,000	10,540,746	122,190,085	6580	10,525,210	88,784,465	7,735,395	65,251,233
63	250,000	10,729,748	132,919,833	6844	10,947,498	99,731,963	8,045,752	73,296,985
78	250,000	10,603,696	143,523,529	7117	11,384,182	111,116,145	8,366,688	81,663,673
78	250,000	10,603,658	154,127,187	7402	11,840,062	122,956,207	8,701,732	90,365,405
78	250,000	10,604,388	164,731,575	7698	12,313,536	135,269,743	9,049,707	99,415,112
78	250,000	10,603,690	175,335,265	8006	12,806,205	148,075,948	9,411,790	108,826,902
59	250,000	10,678,627	186,013,892	8326	13,318,070	161,394,018	9,787,979	118,614,881
53	250,000	10,610,980	196,624,872	8659	13,850,729	175,244,747	10,179,451	128,794,332
53	250,000	10,610,993	207,235,865	9005	14,404,182	189,648,929	10,586,206	139,380,538
53	250,000	10,610,863	217,846,728	9366	14,981,629	204,630,558	11,010,595	150,391,133
53	250,000	10,610,395	228,457,123	9740	15,579,870	220,210,428	11,450,266	161,841,399
48	250,000	10,699,581	239,156,704	10130	16,203,705	236,414,133	11,908,747	173,750,146
34	250,000	10,696,756	249,853,460	10535	16,851,533	253,265,666	12,384,862	186,135,008
34	250,000	10,697,009	260,550,469	10956	17,524,955	270,790,621	12,879,786	199,014,794
34	250,000	10,697,046	271,247,515	11395	18,227,169	289,017,790	13,395,871	212,410,665
34	250,000	10,696,641	281,944,156	11851	18,956,575	307,974,365	13,931,941	226,342,606
59	250,000	10,874,742	292,818,898	12325	19,714,774	327,689,139	14,489,171	240,831,777
31	250,000	10,813,258	303,632,156	12818	20,503,365	348,192,504	15,068,738	255,900,515
1	250,000	10,813,064	314,445,220	13331	21,323,948	369,516,452	15,671,817	271,572,332
1	250,000	10,813,418	325,258,638	13864	22,176,522	391,692,974	16,298,407	287,870,739
1	250,000	10,821,031	336,079,669	14419	23,064,286	414,757,260	16,950,861	304,821,600
8	$7,500,000	$336,079,669			$414,757,260		$304,821,600	

s and revenues have been

LOS ANGELES – SAN FRANCISCO TOLL ROAD STUDY

COMPARISON OF ESTIMATED COSTS WITH ESTIMATED REVENUES BASED ON 100% PATRONAGE BY ASSIGNED USERS

Route Ⓐ 264 MILES

TABLE 9

	Amortization of Construction Cost				Maintenance and Operation			Total Costs			Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
Year [1]	Outstanding at Beginning of Year	Redemption	Interest @ 3-1/4%	Total Debt Service	Roadway Maintenance @ $2000 Per Mile Annually	Toll Collection	Administration	Annual	Cumulative	Estimated Average Daily Traffic (Vehicles)	Annual	Cumulative	Annual	Cumulative
1	$ [illegible]		$ 5,613,400	$ 5,613,400				$ 5,613,400	$ 5,613,400					
2	[illegible]		5,613,400	5,613,400				5,613,400	11,226,800					
3	[illegible]		5,613,400	5,613,400				5,613,400	16,840,200					
4	[illegible]	$ 3,4[illegible]	[illegible],613,400	9,[illegible],400	$ 528,000	$ 651,940	$ 250,000	10,529,340	27,369,540	4623	$ 7,394,840	$ 7,394,840	$ 5,434,762	$ 5,434,762
5	[illegible]	3,[illegible]	5,[illegible],105	9,[illegible],105	528,000	651,940	250,000	10,529,045	37,898,585	4808	7,690,761	15,08[illegible],601	5,652,[illegible]46	11,087,008
6	[illegible]	3,[illegible]	5,[illegible],138	9,099,138	528,000	651,940	250,000	10,529,078	48,427,663	5000	7,997,880	23,083,481	5,877,960	16,964,968
7	[illegible]	[illegible]	[illegible]	9,099,367	528,000	651,940	250,000	10,529,307	58,956,970	5200	8,317,795	31,401,276	6,113,078	23,078,046
8	[illegible]	[illegible]	[illegible]	9,[illegible]	528,000	651,940	250,000	10,528,605	69,485,575	5408	8,650,507	40,051,783	6,357,602	29,435,648
9	[illegible]	[illegible]	[illegible]	9,[illegible]	528,000	664,001	250,000	10,540,934	[illegible],509	5625	8,997,615	49,049,398	6,612,705	36,048,353
10	[illegible]	[illegible]	[illegible]	9,[illegible]	528,000	664,[illegible]	250,000	10,541,308	90,567,517	5850	9,357,520	58,406,918	6,877,213	42,925,566
11	[illegible]	[illegible]	[illegible],760	9,098,760	[illegible],000	664,[illegible]	250,000	10,540,761	101,108,278	6084	9,731,820	68,138,738	7,1[illegible],302	50,077,868
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	664,[illegible]	2[illegible],000	10,541,761	111,649,339	6327	10,1[illegible]17	78,252,255	7,437,970	57,515,838
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	664,[illegible]	2[illegible],000	10,540,746	122,190,085	6580	10,525,210	88,784,465	7,735,395	65,251,233
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	8[illegible],063	250,[illegible]	10,729,748	132,919,833	6844	10,947,498	99,731,963	8,045,722	73,[illegible]
15	[illegible]	[illegible]	[illegible],18	9,[illegible],718	528,000	726,978	2[illegible],000	10,603,696	143,523,529	7117	11,384,182	111,116,145	8,36[illegible]	81,[illegible]3,673
16	[illegible]	[illegible]	[illegible]	[illegible]	528,000	726,978	2[illegible],000	10,603,658	154,127,187	7402	11,84[illegible],062	122,956,207	8,7[illegible]1,732	90,365,405
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	726,978	[illegible]	10,604,388	164,731,575	7698	12,311,536	135,2[illegible]	9,049,707	99,415,112
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	726,978	[illegible]	10,603,690	175,335,265	8006	12,8[illegible],205	148,[illegible]	9,411,790	108,826,902
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	801,1[illegible]	[illegible]	10,678,627	18[illegible],[illegible]13,872	8326	13,318,070	161,39[illegible]	9,7[illegible]	118,614,881
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	733,[illegible]	[illegible]	1[illegible],980	[illegible]	8659	13,850,729	175,244,747	10,179,451	128,794,332
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	733,563	250,000	1[illegible],973	[illegible],235,845	9005	14,404,182	189,648,929	10,586,206	139,380,538
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	[illegible]	[illegible]	1[illegible],663	21[illegible]	[illegible]	14,981,629	204,630,558	11,010,595	150,391,133
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	[illegible]	[illegible]	[illegible]	[illegible],123	[illegible]	1[illegible],579,870	220,21[illegible],428	11,450,266	161,841,[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	[illegible]	[illegible]	1[illegible],659,581	239,1[illegible],704	1[illegible]130	1[illegible],705	236,414,133	11,908,747	173,750,146
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	819,684	[illegible]	1[illegible],696,756	[illegible],460	[illegible]	16,851,533	2[illegible]3,265,[illegible]	12,384,862	186,135,008
26	[illegible]	[illegible]	2,04[illegible]	[illegible]	528,000	819,684	[illegible]	1[illegible],697,009	[illegible],469	10976	17,[illegible],955	270,7[illegible],621	12,879,786	199,014,794
27	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible],697,066	271,[illegible],525	11395	1[illegible],179	28[illegible],790	13,39[illegible],871	212,41[illegible],665
28	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],156	11851	[illegible],575	[illegible],365	13,[illegible]1	226,342,[illegible]
29	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10,[illegible],782	[illegible],938	[illegible]	1[illegible],71[illegible],776	327,[illegible]	14,[illegible],171	240,831,777
30	[illegible]	[illegible]	1,[illegible]	9,[illegible]	[illegible],000	938,[illegible]1	[illegible]	1[illegible],258	[illegible],156	12[illegible]	2[illegible],365	3[illegible]	15,[illegible],739	255,[illegible],515
31	[illegible]	[illegible]	[illegible]	9,[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	31[illegible]	13331	21,323,948	369,516,452	1[illegible],671,817	271,572,332
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	325,2[illegible]	13864	2[illegible],322	3[illegible]	16,[illegible]	28[illegible],670,739
33	[illegible]	[illegible]	[illegible]	9,1[illegible]	[illegible]	9[illegible],341	[illegible]	1[illegible],821,[illegible]	3[illegible]9	14419	2[illegible]	414,757,260	16,[illegible],841	304,821,600
TOTALS		$[illegible],000	$[illegible],702	$2[illegible]9,818,701	$[illegible],000	$2[illegible],968	$7,500,000	$3[illegible],549			$4[illegible],757,260		$304,821,600	

[1] 19[illegible] is assumed as first year of construction.
19[illegible] as first year of operation.
19[illegible] as 30th year of operation and year of final bond maturity.
Traffic is based on estimated use in 19[illegible]. Toll collection costs and revenues have been computed in relation to estimated traffic for each year.

[illegible]
[illegible] Rev.

CHPS 17-5[illegible]

TABLE 10

N FRANCISCO TOLL ROAD STUDY
D COSTS WITH ESTIMATED REVENUES
.TRONAGE BY ASSIGNED USERS

Route Ⓒ 240 MILES

Operation		Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
on	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
		$ 4,062,988	$ 4,062,988					
		4,062,988	8,125,976					
		4,062,988	12,188,964					
40	$ 250,000	7,768,428	19,957,392	4623	$ 6,722,582	$ 6,722,582	$ 4,940,693	$ 4,940,693
40	250,000	7,768,430	27,725,822	4808	6,991,601	13,714,183	5,138,406	10,079,099
40	250,000	7,768,768	35,494,590	5000	7,270,800	20,984,983	5,343,600	15,422,699
40	250,000	7,768,343	43,262,933	5200	7,561,632	28,546,615	5,557,344	20,980,043
40	250,000	7,768,090	51,031,023	5408	7,864,097	36,410,712	5,779,638	26,759,681
10	250,000	7,776,283	58,807,306	5625	8,179,650	44,590,362	6,011,550	32,771,231
10	250,000	7,777,083	66,584,389	5850	8,506,836	53,097,198	6,252,012	39,023,243
10	250,000	7,776,730	74,361,119	6084	8,847,109	61,944,307	6,502,092	45,525,335
10	250,000	7,777,160	82,138,279	6327	9,200,470	71,144,777	6,761,791	52,287,126
10	250,000	7,776,243	89,914,522	6580	9,568,373	80,713,150	7,032,178	59,319,304
18	250,000	7,908,121	97,822,643	6844	9,952,271	90,665,421	7,314,320	66,633,624
16	250,000	7,820,714	105,643,357	7117	10,349,257	101,014,678	7,606,080	74,239,704
16	250,000	7,820,136	113,463,493	7402	10,763,692	111,778,370	7,910,665	82,150,369
16	250,000	7,820,789	121,284,282	7698	11,194,124	122,972,194	8,227,007	90,377,376
16	250,000	7,820,509	129,104,791	8006	11,642,005	134,614,499	8,556,172	98,933,548
04	250,000	7,871,687	136,976,478	8326	12,107,336	146,721,835	8,898,163	107,831,711
85	250,000	7,825,298	144,801,776	8659	12,591,571	159,313,406	9,254,046	117,085,757
85	250,000	7,824,505	152,626,281	9005	13,094,711	172,408,117	9,623,824	126,709,581
85	250,000	7,825,293	160,451,574	9366	13,619,663	186,027,780	10,009,632	136,719,213
85	250,000	7,825,465	168,277,039	9740	14,163,518	200,191,298	10,409,333	147,128,546
79	250,000	7,887,334	176,164,373	10130	14,730,641	214,921,939	10,826,134	157,954,680
53	250,000	7,884,376	184,048,749	10535	15,319,576	230,241,515	11,258,965	169,213,645
53	250,000	7,884,891	191,933,640	10956	15,931,777	246,173,292	11,708,896	180,922,541
53	250,000	7,885,173	199,818,813	11395	16,570,153	262,743,445	12,178,064	193,100,605
53	250,000	7,885,061	207,703,874	11851	17,233,250	279,976,695	12,665,401	205,766,006
05	250,000	8,008,043	215,711,917	12325	17,922,522	297,899,217	13,171,974	218,937,980
40	250,000	7,965,988	223,677,905	12818	18,639,423	316,538,640	13,698,853	232,636,833
40	250,000	7,965,650	231,643,555	13331	19,385,407	335,924,047	14,247,106	246,883,939
40	250,000	7,966,203	239,609,758	13864	20,160,474	356,084,521	14,816,734	261,700,673
40	250,000	7,974,418	247,584,176	14419	20,967,533	377,052,054	15,409,874	277,110,547
32	$7,500,000	$247,584,176			$377,052,054		$277,110,547	

•
sts and revenues
year.

TABLE 10

LOS ANGELES – SAN FRANCISCO TOLL ROAD STUDY

COMPARISON OF ESTIMATED COSTS WITH ESTIMATED REVENUES BASED ON 100% PATRONAGE BY ASSIGNED USERS

Route Ⓒ 240 MILES

Year 1/	Amortization of Construction Cost				Maintenance and Operation			Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
	Outstanding at Beginning of Year	Redemption	Interest @ 3-1/4%	Total Debt Service	Roadway Maintenance @ $2000 Per Mile Annually	Toll Collection	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
1	$[illegible]		$ 4,[illegible]	$ 4,0[illegible],988				$ 4,062,988	$ 4,062,988					
2	[illegible]		[illegible]	[illegible]				4,062,988	8,125,976					
3	[illegible]		[illegible]	4,06[illegible],988				4,06[illegible],988	12,188,964					
4	[illegible]	$ [illegible]	[illegible]	[illegible],988	$ 4[illegible],000	$ 452,440	$ 250,000	7,768,428	19,95[illegible],392	4623	$ 6,722,582	$ 6,722,582	$ 4,940,693	$ 4,940,693
5	[illegible]	[illegible]	[illegible]	[illegible],990	[illegible],000	452,440	250,000	7,768,430	27,725,822	4806	6,991,601	13,714,1[illegible]3	5,13[illegible],406	10,079,099
6	11[illegible]	[illegible]	[illegible]	6,[illegible]	480,000	452,440	250,000	7,768,768	35,494,590	5000	7,270,800	20,984,983	5,343,600	15,422,699
7	11[illegible]	[illegible]	[illegible]	6,[illegible]	480,000	452,440	250,000	7,768,343	43,262,933	5200	7,561,632	28,546,615	5,557,344	20,9[illegible],043
8	11[illegible]	[illegible]	[illegible]	6,[illegible]	[illegible]	452,440	250,000	7,768,090	51,[illegible]	5408	7,864,097	36,[illegible],712	5,779,638	26,759,681
9	11[illegible]	[illegible]	[illegible]	6,[illegible]	480,000	460,810	250,000	7,776,283	58,8[illegible]7,306	5625	8,179,650	44,590,362	6,[illegible]11,550	3[illegible],771,231
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	460,810	250,000	7,777,083	66,584,389	5850	8,506,836	53,097,198	6,252,[illegible]	39,023,[illegible]
11	[illegible]	[illegible]	[illegible]	6,[illegible]	[illegible]	460,810	250,000	7,776,730	74,361,119	6084	8,847,109	61,944,307	6,50[illegible],292	45,525,335
12	[illegible]	[illegible]	[illegible]	6,[illegible]	[illegible]	460,810	250,000	7,777,160	82,138,[illegible]79	[illegible]327	9,200,470	71,144,777	6,761,791	52,287,126
13	[illegible]	[illegible]	[illegible]	6,[illegible]	[illegible],000	460,810	250,000	7,776,243	[illegible],914,522	6580	9,568,373	80,713,150	7,03[illegible],178	59,319,304
14	[illegible]	[illegible]	[illegible]	6,[illegible]	480,000	[illegible],018	[illegible]50,000	7,900,121	97,8[illegible],643	6844	9,95[illegible],271	90,[illegible]	7,314,320	66,633,624
15	[illegible]	[illegible]	[illegible]	6,[illegible]	[illegible]	504,[illegible]16	2[illegible],000	7,820,714	1[illegible],643,357	7117	10,349,257	1[illegible]1,014,678	7,60[illegible],080	74,239,704
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	504,516	250,000	7,820,136	113,[illegible]	7402	10,763,692	111,778,370	7,91[illegible],665	82,150,369
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	504,516	2[illegible],000	7,8[illegible],789	1[illegible],282	7698	11,194,124	122,[illegible]	8,22[illegible]07	90,377,376
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	504,[illegible]	2[illegible],000	7,[illegible],509	[illegible]	[illegible]	11,642,0[illegible]5	13[illegible],614,499	8,55[illegible],172	98,933,548
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	536,[illegible]	2[illegible],000	7,[illegible],687	[illegible],476,478	[illegible]	1[illegible],107,336	146,721,[illegible]35	8,8[illegible],163	107,[illegible]1,711
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	509,085	2[illegible],000	7,[illegible],298	[illegible],776	8659	12,591,571	159,313,[illegible]	9,25[illegible]	117,[illegible],757
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	509,[illegible]5	250,000	7,[illegible],505	1[illegible]	9005	13,[illegible],711	172,40[illegible],117	[illegible],623,824	126,709,581
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	509,[illegible]	2[illegible],000	7,[illegible],293	1[illegible]	9366	13,617,[illegible]	18[illegible],760	10,0[illegible],632	136,717,213
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	509,[illegible]5	2[illegible],000	7,[illegible]	1[illegible]	97[illegible]	1[illegible],163,528	20[illegible],191,298	10,[illegible],133	147,126,[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5[illegible]	2[illegible],000	7,[illegible]	176,1[illegible]	10130	1[illegible],73[illegible],641	214,[illegible]1,939	10,[illegible]	157,[illegible],680
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	568,853	2[illegible],000	7,[illegible],376	184,[illegible]	10535	1[illegible],5[illegible]6	2[illegible],241,51[illegible]	11,[illegible]65	1[illegible],213,645
26	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible],000	[illegible]	250,000	7,88[illegible]	191,[illegible]	109[illegible]	1[illegible],777	246,173,[illegible]	11,7[illegible]	18[illegible],922,9[illegible]1
27	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible],000	[illegible]	2[illegible]	[illegible]	199,[illegible]	113[illegible]	1[illegible],153	[illegible]	1[illegible],17[illegible]	193,[illegible]
28	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible],000	[illegible]	2[illegible]	7,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	642,[illegible]	2[illegible],000	8,[illegible]	[illegible],217	[illegible]	[illegible]	[illegible],217	1[illegible],171,[illegible]	218,937,[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250,000	7,[illegible]	[illegible]	[illegible]	[illegible]	316,5[illegible]	[illegible]	23[illegible],536,633
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]80,000	[illegible],840	2[illegible]	[illegible],965,650	[illegible]	1[illegible]	[illegible]07	335,[illegible]	[illegible],247,1[illegible]6	246,883,939
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	649,840	2[illegible],000	[illegible]	[illegible]	[illegible]	[illegible]	35[illegible]	1[illegible]	261,700,673
33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],000	649,840	250,000	7,[illegible]	[illegible]	1[illegible]419	[illegible],533	377,[illegible]	15,[illegible]	277,110,947
TOTALS		$1[illegible]	$[illegible]	$[illegible]	$1[illegible]	$[illegible],932	$[illegible],500,000	$[illegible],176			$[illegible]		$[illegible]77,110,947	

1/ [illegible]

[illegible] collection costs and revenues [illegible] for each year.

[illegible]

[illegible] 12-5-57

TABLE II

ANGELES- SAN FRANCISCO TOLL ROAD STUDY

F ESTIMATED COSTS WITH ESTIMATED REVENUES ON 100% PATRONAGE BY ASSIGNED USERS

Route C_1 258 MILES

	Maintenance and Operation			Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
tal Service	Roadway Maintenance @ $2000 Per Mile Annually	Toll Collection	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
81,723				$ 4,681,723	$ 4,681,723					
81,723				4,681,723	9,363,446					
81,723				4,681,723	14,045,169					
88,723	$ 516,000	$ 496,140	$ 250,000	8,850,863	22,896,032	4,867	$ 7,608,201	$ 7,608,201	$ 5,591,570	$ 5,591,570
89,245	516,000	496,140	250,000	8,851,385	31,747,417	5,061	7,911,466	15,519,667	5,814,451	11,406,021
88,680	516,000	496,140	250,000	8,850,820	40,598,237	5,264	8,228,800	23,748,467	6,047,673	17,453,694
88,963	516,000	496,140	250,000	8,851,103	49,449,340	5,474	8,557,077	32,305,544	6,288,936	23,742,630
88,963	516,000	496,140	250,000	8,851,103	58,300,443	5,693	8,899,423	41,204,967	6,540,540	30,283,170
88,583	516,000	505,319	250,000	8,859,902	67,160,345	5,921	9,255,837	50,460,804	6,802,483	37,085,653
88,725	516,000	505,319	250,000	8,860,044	76,020,389	6,158	9,626,321	60,087,125	7,074,766	44,160,419
89,600	516,000	505,319	250,000	8,860,919	84,881,308	6,404	10,010,873	70,097,998	7.357,389	51,517,808
89,058	516,000	505,319	250,000	8,860,377	93,741,685	6,660	10,411,059	80,509,057	7,651,501	59,169,309
89,020	516,000	505,319	250,000	8,860,339	102,602,024	6,927	10,828,438	91,337,495	7,958,250	67,127,559
89,018	516,000	649,199	250,000	9,004,217	111,606,241	7,204	11,261,451	102,598,946	8,276,488	75.404,047
88,920	516,000	553,246	250,000	8,908,166	120,514,407	7,492	11,711,659	114,310,605	8,607,364	84,011,411
88,598	516,000	553,246	250,000	8,907,844	129,422,251	7,792	12,180,626	126,491,231	8,952,026	92,963,437
88,920	516,000	553,246	250,000	8,908,166	138,330,417	8,103	12,666,788	139,158,019	9,309,326	102,272,763
88,725	516,000	553,246	250,000	8,907,971	147,238,388	8,427	13,173,272	152,331,291	9,681,561	111,954,324
88,883	516,000	609,706	250,000	8,964,589	156,202,977	8,764	13,700,078	166,031,369	10,068,732	122,023,056
89,230	516,000	558,257	250,000	8,913,487	165,116,464	9,115	14,248,769	180,280,138	10,471,987	132,495,043
88,605	516,000	558,257	250,000	8,912,862	174,029,326	9,480	14,819,345	195,099,483	10,891,326	143,386,369
88,878	516,000	558,257	250,000	8,913,135	182,942,461	9,859	15,411,806	210,511,289	11,326,749	154,713,118
88,853	516,000	558,257	250,000	8,913,110	191,855,571	10,253	16,027,715	226,539,004	11,779,405	166,492,523
88,368	516,000	626,129	250,000	8,980,497	200,836,068	10,663	16,666,836	243,205,840	12,250,443	178,742,966
89,260	516,000	623.797	250.000	8,979,057	209,815,125	11,090	17,336.132	260,541.972	12.741,013	191.483.979
89,303	516,000	623,797	250,000	8,979,100	218,794,225	11,533	18,028,639	278,570,611	13,249,964	204,733,943
89,333	516,000	623,797	250,000	8,979,130	227,773,355	11,995	18,750,848	297,321,459	13.780,744	218,514,687
89,155	516,000	623,797	250,000	8,978,952	236,752,307	12,475	19,501,194	315,822,653	14,332,203	232,846,890
88,575	516,000	759,392	250,000	9,113,967	245.866,274	12,974	20,281,242	337,103,895	14,905.491	247,752,381
88,398	516,000	712,606	250,000	9,067,004	254,933,278	13,493	21,092,554	358,196,449	15,501,757	263,254,138
88,395	516,000	712,606	250,000	9,067,001	264,000,279	14,032	21,935,131	380,131,580	16,121,000	279,375,138
89,340	516,000	712,606	250,000	9,067,946	273,068,225	14,593	22,812,099	402,943,679	16,765,518	296,140,656
91,972	516,000	712,606	250,000	9,070,578	282,138,803	15,177	23,725,020	426,668,699	17,436,461	313,577,117
15,458	$15,480,000	$17,443,345	$7,500,000	$282,138,803			$426,668,699		$313,577,117	

construction

d year of final bond maturity.
in 1950. Toll collection costs
n relation to estimated traffic

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY

COMPARISON OF ESTIMATED COSTS WITH ESTIMATED REVENUES BASED ON 100% PATRONAGE BY ASSIGNED USERS

Route C1 258 MILES

TABLE II

	Amortization of Construction Cost				Maintenance and Operation			Total Costs			Estimated Revenue @ $ .0166 Per Vehicle Mile		Estimated Revenue @ $ .01[illegible] Per Vehicle Mile	
Year 1/	Outstanding at Beginning of Year	Redemption	Interest @ [illegible]	Total Debt Service	Roadway Maintenance @ $2000 Per Mile Annually	Toll Collection	Administration	Annual	Cumulative	Estimated Average Daily Traffic (Vehicles)	Annual	Cumulative	Annual	Cumulative
1	$ [illegible]		$ [illegible]	$ [illegible]				$ 4,681,723	$ 4,681,723					
2	[illegible]		[illegible]	[illegible]				[illegible]	[illegible]					
3	[illegible]		[illegible]	[illegible]				[illegible]	14,045,169					
4	[illegible]	$ [illegible]	[illegible]	[illegible]	$ 516,000	$ [illegible]	$ 250,000	[illegible]	[illegible]	4,867	$ [illegible]	$ [illegible]	$ [illegible]	$ 5,591,970
5	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	[illegible]	31,747,417	5,061	7,911,[illegible]	15,519,[illegible]	[illegible]	11,406,021
6	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	8,850,820	[illegible]	5,264	8,228,800	23,748,467	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	[illegible]	[illegible]	[illegible]	8,557,077	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	[illegible]	[illegible]	5,693	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	[illegible]	67,160,345	[illegible]	[illegible]	50,460,804	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	516,000	[illegible]	250,000	[illegible]	76,020,[illegible]	[illegible]	[illegible]	[illegible]	7,074,[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250,000	8,860,219	[illegible]	[illegible]	10,010,873	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250,000	[illegible]	[illegible]	6,660	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,927	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250,000	9,004,217	[illegible]	7,204	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,492	11,711,[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,792	12,180,62[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12,666,7[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13,173,272	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	250,000	[illegible]	156,202,[illegible]	[illegible]	13,700,079	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9,115	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals		[illegible]	[illegible]	[illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]			$ [illegible]		$ [illegible]	

1/ [illegible] is assumed as "first year" of construction
[illegible]
[illegible]
[illegible]
[illegible]

AN FRANCISCO TOLL ROAD STUDY

ED COSTS WITH ESTIMATED REVENUES

'ATRONAGE BY ASSIGNED USERS

ute D 240 MILES

TABLE 12

and Operation		Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
Toll ection	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
		$ 4,880,270	$ 4,880,270					
		4,880,270	9,760,540					
		4,880,270	14,640,810					
76,180	$ 250,000	9,216,450	23,857,260	7543	$ 10,968,729	$ 10,968,729	$ 8,061,355	$ 8,061,355
76,180	250,000	9,216,775	33,074,035	7845	11,407,885	22,376,614	8,384,108	16,445,463
76,180	250,000	9,216,083	42,290,118	8159	11,864,491	34,241,105	8,719,686	25,165,149
76,180	250,000	9,216,108	51,506,226	8485	12,338,548	46,579,653	9,068,089	34,233,238
76,180	250,000	9,216,720	60,722,946	8825	12,832,962	59,412,615	9,431,454	43,664,692
86,839	250,000	9,227,449	69,950,395	9178	13,346,280	72,758,895	9,808,712	53,473,404
86,839	250,000	9,226,879	79,177,274	9545	13,879,957	86,638,852	10,200,932	63,674,336
86,839	250,000	9,227,572	88,404,846	9926	14,433,992	101,072,844	10,608,115	74,282,451
86,839	250,000	9,227,364	97,632,210	10323	15,011,294	116,084,138	11,032,397	85,314,848
86,839	250,000	9,227,159	106,859,369	10736	15,611,862	131,696,000	11,473,778	96,788,626
53,932	250,000	9,393,920	116,253,289	11166	16,237,151	147,933,151	11,933,328	108,721,954
42,498	250,000	9,282,896	125,536,185	11612	16,885,706	164,818,857	12,409,977	121,131,931
42,498	250,000	9,282,886	134,819,071	12077	17,561,890	182,380,747	12,906,931	134,038,862
42,498	250,000	9,283,326	144,102,397	12560	18,264,250	200,644,997	13,423,123	147,461,985
42,498	250,000	9,283,053	153,385,450	13062	18,994,238	219,639,235	13,959,621	161,421,606
08,068	250,000	9,348,508	162,733,958	13585	19,754,764	239,393,999	14,518,561	175,940,167
48,318	250,000	9,288,638	172,022,596	14128	20,544,372	259,938,371	15,098,876	191,039,043
48,318	250,000	9,288,351	181,310,947	14693	21,365,973	281,304,344	15,702,703	206,741,746
48,318	250,000	9,288,733	190,599,680	15281	22,221,019	303,525,363	16,331,110	223,072,856
48,318	250,000	9,288,591	199,888,271	15892	23,109,511	326,634,874	16,984,098	240,056,954
27,139	250,000	9,367,582	209,255,853	16528	24,034,356	350,669,230	17,663,804	257,720,758
24,431	250,000	9,365,161	218,621,014	17189	24,995,556	375,664,786	18,370,228	276,090,986
24,431	250,000	9,364,371	227,985,385	17877	25,996,018	401,660,804	19,105,507	295,196,493
24,431	250,000	9,364,341	237,349,726	18592	27,035,743	428,696,547	19,869,642	315,066,135
24,431	250,000	9,364,844	246,714,570	19336	28,117,638	456,814,185	20,664,770	335,730,905
31,901	250,000	9,522,121	256,236,691	20109	29,241,703	486,055,888	21,490,890	357,221,795
27,567	250,000	9,467,705	265,704,396	20913	30,410,848	516,466,736	22,350,141	379,571,936
27,567	250,000	9,467,505	275,171,901	21750	31,627,980	548,094,716	23,244,660	402,816,596
27,567	250,000	9,467,960	284,639,861	22620	32,893,099	580,987,815	24,174,446	426,991,042
27,567	250,000	9,475,810	294,115,671	23525	34,209,114	615,196,929	25,141,638	452,132,680
57,391	$7,500,000	$294,115,671			$615,196,929		$452,132,680	

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TABLE 12

LOS ANGELES–SAN FRANCISCO TOLL ROAD STUDY

COMPARISON OF ESTIMATED COSTS WITH ESTIMATED REVENUES BASED ON 100% PATRONAGE BY ASSIGNED USERS

Route Ⓓ 240 MILES

	Amortization of Construction Cost				Maintenance and Operation			Total Costs		Estimated Average Daily Traffic (Vehicles)	Estimated Revenue @ $.0166 Per Vehicle Mile		Estimated Revenue @ $.0122 Per Vehicle Mile	
Year 1/	Outstanding at Beginning of Year	Redemption	Interest @ 3-1/4%	Total Debt Service	Roadway Maintenance @ $2000 Per Mile Annually	Toll Collection	Administration	Annual	Cumulative		Annual	Cumulative	Annual	Cumulative
1	$ 150,156,000		$ 4,880,270	$ 4,880,270				$ 4,880,270	$ 4,880,270					
2	150,156,000		4,880,270	4,880,270				4,880,270	9,760,540					
3	150,156,000		4,880,270	4,880,270				4,880,270	14,640,810					
4	150,156,000	$ 3,030,000	4,880,270	7,910,270	$ 480,000	$ 576,180	$ 250,000	9,216,450	23,857,260	7543	$ 10,968,729	$ 10,968,729	$ 8,061,355	$ 8,061,355
5	147,126,000	3,129,000	4,781,595	7,910,595	480,000	576,180	250,000	9,216,775	33,074,035	7845	11,407,885	22,376,614	8,384,108	16,445,463
6	143,997,000	3,230,000	4,679,903	7,909,903	480,000	576,180	250,000	9,216,083	42,290,118	8159	11,864,491	34,241,105	8,719,686	25,165,149
7	140,767,000	3,335,000	4,574,928	7,909,928	480,000	576,180	250,000	9,216,108	51,506,226	8485	12,338,548	46,579,653	9,068,089	34,233,238
8	137,432,000	3,444,000	4,466,540	7,910,540	480,000	576,180	250,000	9,216,720	60,722,946	8825	12,832,962	59,412,615	9,431,454	43,664,692
9	133,988,000	3,556,000	4,354,610	7,910,610	480,000	586,839	250,000	9,227,449	69,950,395	9178	13,346,280	72,758,895	9,808,712	53,473,404
10	130,432,000	3,671,000	4,239,040	7,910,040	480,000	586,839	250,000	9,226,879	79,177,274	9545	13,879,957	86,638,852	10,200,932	63,674,336
11	126,761,000	3,791,000	4,119,733	7,910,733	480,000	586,839	250,000	9,227,572	88,404,846	9926	14,433,992	101,072,844	10,608,115	74,282,451
12	122,970,000	3,914,000	3,996,525	7,910,525	480,000	586,839	250,000	9,227,364	97,632,210	10323	15,011,294	116,084,138	11,032,397	85,314,848
13	119,056,000	4,041,000	3,869,320	7,910,320	480,000	586,839	250,000	9,227,159	106,859,369	10736	15,611,862	131,696,000	11,473,778	96,788,626
14	115,015,000	4,172,000	3,737,988	7,909,988	480,000	753,932	250,000	9,393,920	116,253,289	11166	16,237,151	147,933,151	11,933,328	108,721,954
15	110,843,000	4,308,000	3,602,398	7,910,398	480,000	642,498	250,000	9,282,896	125,536,185	11612	16,885,706	164,818,857	12,409,977	121,131,931
16	106,535,000	4,448,000	3,462,388	7,910,388	480,000	642,498	250,000	9,282,886	134,819,071	12077	17,561,890	182,380,747	12,906,931	134,038,862
17	102,087,000	4,593,000	3,317,828	7,910,828	480,000	642,498	250,000	9,283,326	144,102,397	12560	18,264,250	200,644,997	13,423,123	147,461,985
18	97,494,000	4,742,000	3,168,555	7,910,555	480,000	642,498	250,000	9,283,053	153,385,450	13062	18,994,238	219,639,235	13,959,621	161,421,606
19	92,752,000	4,896,000	3,014,440	7,910,440	480,000	708,068	250,000	9,348,508	162,733,958	13585	19,754,764	239,393,999	14,518,561	175,940,167
20	87,856,000	5,055,000	2,855,320	7,910,320	480,000	648,318	250,000	9,288,638	172,022,596	14128	20,544,372	259,938,371	15,098,876	191,039,343
21	82,801,000	5,219,000	2,691,033	7,910,033	480,000	648,318	250,000	9,288,351	181,310,947	14693	21,365,973	281,304,344	15,702,703	206,741,746
22	77,582,000	5,389,000	2,521,415	7,910,415	480,000	648,318	250,000	9,288,733	190,599,680	15281	22,221,019	303,525,363	16,331,110	223,072,856
23	72,193,000	5,564,000	2,346,273	7,910,273	480,000	648,318	250,000	9,288,591	199,888,271	15892	23,109,511	326,634,874	16,984,098	240,056,954
24	66,629,000	5,745,000	2,165,443	7,910,443	480,000	727,139	250,000	9,367,582	209,255,853	16528	24,034,356	350,669,230	17,663,804	257,720,758
25	60,884,000	5,932,000	1,978,730	7,910,730	480,000	724,431	250,000	9,365,161	218,621,014	17189	24,995,556	375,664,786	18,370,228	276,090,986
26	54,952,000	6,124,000	1,785,940	7,909,940	480,000	724,431	250,000	9,364,371	227,985,385	17877	25,996,018	401,660,804	19,105,507	295,196,493
27	48,828,000	6,323,000	1,586,910	7,909,910	480,000	724,431	250,000	9,364,341	237,349,726	18592	27,035,743	428,696,547	19,869,642	315,066,135
28	42,505,000	6,529,000	1,381,413	7,910,413	480,000	724,431	250,000	9,364,844	246,714,570	19336	28,117,638	456,814,185	20,664,770	335,730,905
29	35,976,000	6,741,000	1,169,220	7,910,220	480,000	881,901	250,000	9,522,121	256,236,691	20109	29,241,703	486,055,888	21,490,890	357,221,795
30	29,235,000	6,960,000	950,138	7,910,138	480,000	827,567	250,000	9,467,705	265,704,396	20913	30,410,848	516,466,736	22,350,141	379,571,936
31	22,275,000	7,186,000	723,938	7,909,938	480,000	827,567	250,000	9,467,505	275,171,901	21750	31,627,980	548,094,716	23,244,660	402,816,596
32	15,089,000	7,420,000	490,393	7,910,393	480,000	827,567	250,000	9,467,960	284,639,861	22620	32,893,099	580,987,815	24,174,446	426,991,042
33	7,669,000	7,669,000	249,243	7,918,243	480,000	827,567	250,000	9,475,810	294,115,671	23525	34,209,114	615,196,929	25,141,638	452,132,680
TOTALS		$150,156,000	$101,802,280	$251,958,280	$14,400,000	$20,257,391	$7,500,000	$294,115,671			$615,196,929		$452,132,680	

1/ 1952 is assumed as first year of construction
1955 as first year of operation
1984 as 30th year of operation and year of final bond maturity
Traffic is based on estimated use in 1950. Toll collection costs and revenues have been computed in relation to estimated traffic for each year.

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Route A would not be financially feasible. However, Routes C, C_1, and D would be in the black and pay out within the 30 year period.

The result might be stated another way. If 89.5 percent, 89.8 percent, and 65.0 percent of the traffic on Routes C, C_1, and D, respectively, would pay the tolls, then the routes would earn just enough to extinguish their debts and meet annual costs in 30 years. Again, this is without regard for any deficit financing in the earlier years.

Now there is not much information obtainable for estimating what portion of free road traffic would pay toll. House Document No. 272, 76th Congress states: It was considered that the factor might range from .167 to .40, and generally average 1/3. In this study a factor of .40 will be assumed, and it is considered high rather than low because all of the routes except perhaps Route C are not far removed from existing State Highways from which they would receive competition.

In light of this assumption it can be seen that neither Routes C nor C_1, nor D would pay out in 30 years at an average toll of 1.22 cents. (Table 13) The rate that would have to be obtained would range from 2 cents on Route D to 3.4 cents on Route A. These rates are considerably in excess of those for the Maine Turnpike and indeed of those for the Pennsylvania Turnpike which offers advantages over existing public highways that none of the routes studied in California possesses.

TABLE 13

SUMMARY OF 30 YEARS OPERATIONS

Route	Total Costs (Millions of Dollars)	Revenue from 100% of traffic at 1.22¢ p.m.v. (Millions of Dollars)	Percent of Traffic needed as toll paying at 1.22¢ p.m.v. To Pay Costs	Toll Rate per veh. mi. needed to pay costs in 30 yrs. if 40% of traffic patronizes		
				Average Rate (cents)	Autos (cents)	Trucks (cents)
A	336	305	110.2	3.36	1.00	11.73
C	248	277	89.5	2.73	1.00	8.87
C_1	282	314	89.8	2.74	1.00	8.90
D	294	452	65.0	1.98	1.00	5.47

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V

CONCLUSION

It appears from the evidence that has been presented that at this time a toll road from a terminus in San Francisco to one in Los Angeles is not feasible from engineering and financial viewpoints. Further, no toll route seems financially practicable over a major part of the distance; that is between Wheeler Ridge and a point near San Jose, or alternately, a point near Tracy.

Every effort has been made to set forth fully the premises upon which the discussion and conclusion rest. Most of the assumptions made are well supported by a solid body of fact. But in some cases where little factual evidence is available, subjective judgment was necessarily used. These judgments are believed to be sound.

In closing this report one further and important note is made. The feasibility of constructing and operating a toll road from San Francisco to Los Angeles has been studied from engineering and financial viewpoints alone. Thus, the report does not go into the question of toll roads as instruments of public policy. It neither delves into their legal aspects nor considers their practicability in other sections of the State. It contains no discussion of what effect a toll road would have on the roads of various systems -- State, County, or City -- with which it would come in contact. In short, the report is limited to those matters specified in the resolution.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

APPENDIX

1. Los Angeles - San Francisco Toll Road Study Interchange of Auto and Truck Trips. Centroid of Each Zone as Indicated.
2. Interchange of Maximum Potential Traffic -- Route A
3. Interchange of Maximum Potential Traffic -- Route C
4. Interchange of Maximum Potential Traffic -- Route C_1
5. Interchange of Maximum Potential Traffic -- Route D
6. Map Showing Zone Boundaries
7. Road Map of California

TE OF CALIFORNIA
SION OF HIGHWAYS

FRANCISCO TOLL ROAD STUDY
OF AUTO AND TRUCK TRIPS

of each zone as indicated.

	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	
																									6
																									8931
																									6632
																									570
																									5930
																									698
																									426
																									[illegible]
																									4644
																									207
																									117
																									[illegible]
																									[illegible]
5	1327																								1984
4	33																								466
8	19		8																						260
9	1																								71
4	4	18	9	69	1555																				1753
2	2	18	9	20	167																				334
1	1	4	5	4	10	82	2050																		2256
7	16	10	[illegible]	3	10	41	93	1																	1890
4	4	2	4	1	2	21	20																		781
7	18	18	13	10	17	48	65	1																	2693
2	2	5	3	2	3	6	8																		225
3	5	1	3	2	2	10	9	1																	391
7	564	2	103	5	8	17	12	50	12	47	10	13	1												[illegible]
0	107	1	22	7	6	11	5	35	9	72	6	8	31	67											1211
1	229	2	26		291	284	56	383	84	461	62	50	1124	989	5										6829
1	7	1		3	45	57	14	33	13	36	7	12	30	18	47	187									664
4	16	19	14	21	30	2	19	168	35	193	27	21	28	33	1092	965									2957
5	20	16	14	9	29	119	801	598	91	475	48	28	52	30	349	77	661	4959							9056
1	3	2	3	2	5	16	64	222	37	142	8	5	5	5	42	6	44	172							963
1	3	3	4	2	20	23	56	373	38	133	18	11	12	7	59	7	31	70	37	240					[illegible]
0	59	30	32	15	34	89	157	1057	273	674	28	14	132	81	793	100	368	397	1	149	6				7266
		3					1	2		1					8		2	2			1				25
3	3					1	3	352	82	335	37	21	9	4	12	2	18	63	14	24	126				1494
	1		1		2	3	2	200	56	154	9	1	1	2	20	2	3	15		6					567
9	2444	155	497	175	2236	830	3435	3476	730	2723	260	184	1425	1236	2427	1346	1127	5678	52	419	133				[illegible]

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STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS

Centroid of each zone as indicated.

ZONE	CENTROID	ZONE 01	02	11	12	13	21	22	23	24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	
01	Los Angeles	6																																						[illegible]
02	San Bernardino																																							[illegible]
11	Ventura	522	7	8402																																				[illegible]
12	Santa Barbara	2198	74	4580																																				[illegible]
13	Santa Maria	395	32	141	2																																			[illegible]
21	Paso Robles	872	35	112	351	346	3314																																	[illegible]
22	King City	190	2	33	138	124	211																																	[illegible]
23	Salinas	233	9	16	43	27	97		1																															[illegible]
24	Gilroy	27	4			11	22		2																															[illegible]
25	San Jose	267	29	19	29	35	99	95	865	2540	868																													[illegible]
31	Gorman	44	2	35	31	1	1		3	3	3	84																												[illegible]
32	Barstow	7			6	37	16	4	27	2	18																													[illegible]
33	Bakersfield	2388	77	135	63		167	16	35	13	76	475	4	1																										[illegible]
41	Taft	313	8	37	10	7	81	2	5	2	14	73	1																											[illegible]
42	Delano	299	18	13	8	30	74	1	5	14	29	16	4	141	5	1327																								[illegible]
43	Coalinga	54	3	6	1	22	44		2	4	11	3	139		144	33																								[illegible]
44	Hanford	97	5	3		3	10		3	4	18	4	10	68	8	19		8																						[illegible]
45	Kerman	12			1				6	10	13	1	4	14	9	1																								[illegible]
46	Mendota	16	11				4	1	5	7	28	2	4	16	4	4	18	9	69	1555																				[illegible]
47	Los Banos	20	4				2				71	1	3	15	2	2	18	9	20	167																				[illegible]
48	Newman	20	1	1	1		1		6	7	55	1	3	3	1	1	4	5	4	10	82	2050																		[illegible]
51	Oakland	568	32	18	40	21	87	37	448	183	81	3	70	101	7	16	10	2	3	10	41	93	1																	[illegible]
52	Redwood City	132	11	6	21	19	37	20	241	146	54		15	21	4	4	2	4	1	2	21	20																		[illegible]
53	San Francisco	886	40	47	72	46	165	63	765	178	82	3	51	98	7	18	18	13	10	17	48	65	1																	[illegible]
54	San Rafael	79	6	2	7	6	7	7	52	14	4		14	16	2	2	5	3	2	3	6	8																		[illegible]
55	Santa Rosa	112	11	7	9	7	20	6	96	40	13	2	11	21	3	5	1	3	2	2	10	9	1																	[illegible]
61	Tulare	398	17	14	16	21	45		11	11	61	10	22	388	17	564	2	103	5	8	17	12	50	12	47	10	13	1												[illegible]
62	Visalia	349	15	11	12	4	9		11	8	43	7	16	125	10	107	1	22	7	6	11	5	35	9	72	6	8	31	67											[illegible]
63	Fresno	1215	81	39	31	26	33	9	131	85	313	32	726	21	41	229	2	26		291	284	56	383	84	461	62	50	1124	989	5										[illegible]
64	Madera	52	2	1		3			18	13	36	1	5	22	1	7	1		3	45	57	14	33	13	36	7	12	30	18	47	187									[illegible]
71	Merced	119	9	2	1	1	9		1		60	3	15	50	4	16	19	14	21	30	2	19	168	35	193	27	21	28	33	1092	965									[illegible]
72	Modesto	177	20	6	1	3	8	1	54	29	288	3	25	60	5	20	16	14	9	29	119	801	598	91	475	48	28	52	30	349	77	661	4059							[illegible]
73	Manteca	34	3	1	1	1	2	2	12	9	104	1	7	7	1	3	2	3	2	5	16	64	222	37	142	8	5	5	5	42	6	44	172							[illegible]
74	Tracy	71	6	2	2	1	4	3	41	17	107	1	13	17	1	3	3	4	2	20	23	56	373	38	133	18	11	12	7	59	7	31	76	37	240					[illegible]
81	Stockton	1040	65	31	13	12	38	16	261	82	912	14	62	221	10	59	30	32	15	34	89	157	1057	273	674	28	14	132	81	793	100	368	397	1	144	6				[illegible]
91	Bishop	1		2							2						3					1	2		1					8		2	2			1				[illegible]
92	Yosemite	246	6	4	3		6		9	2	75	3	4	27	3	3					1	3	352	82	335	37	21	9	4	12	2	18	93	14	24	126				[illegible]
93	Sonora	2	1	1	1			1	4	5	52		4			1		1		2	3	2	200	56	154	9	1	1	2	20	2	3	15		6					[illegible]
	TOTALS	13461	646	13727	914	814	4613	284	3120	3428	3491	743	1232	1453	289	2444	155	497	175	2236	830	3435	3476	730	2723	260	184	1425	1236	2427	1346	1127	5678	52	414	133				[illegible]

Ref: Tab. #8969
RDB:emc 12-16-50

JPS (T-5383)

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

Route A

LOS ANGELES-SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS
MAXIMUM POTENTIAL

Centroid of each zone as indicated.

ZONE	CENTROID	ZONE 01	02	11	12	13	21	22	23	24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	TOTALS
01	Los Angeles																																							
02	San Bernardino																																							
11	Ventura																																							
12	Santa Barbara																																							
13	Santa Maria																																							
21	Paso Robles	58• 814	2• 33																																					60• 847
22	King City	14• 176	1• 1	2• 31	8• 130	24• 100	65• 146																																	114• 584
23	Salinas	23• 210	2• 7	2• 14	5• 38	3• 24	8• 89																																	43• 382
24	Gilroy	2• 25	1• 3			6• 5	3• 19		1• 1																															13• 53
25	San Jose	50• 217	4• 25	3• 16	2• 27	9• 26	14• 85	29• 66	215• 650																															326• 1112
31	Gorman					1	1		3	2• 1	3																													2• 9
32	Barstow					11• 26	16	4	1• 26	2	1• 17																													13• 91
33	Bakersfield				3• 60		42• 125	9• 7	3• 32	5• 8	20• 56																													82• 288
41	Taft	67• 246	1• 7				26• 55	2	5	1• 1	5• 9	22• 52																												122• 376
42	Delano							1	1• 4																															1• 5
43	Coalinga	10• 44	1• 2						1• 1			1• 2																												13• 49
44	Hanford								3		2• 16																													2• 19
45	Kerman								1• 5		5• 8																													6• 13
46	Mendota							1	5		6• 22																													6• 28
47	Los Banos						2•				28• 43																													30• 43
48	Newman				1		1		1• 5		16• 39																													17• 46
51	Oakland	137• 431	4• 28	3• 15	1• 39	2• 19	12• 75	9• 28	108• 340	74• 109	33• 48	1• 2	9• 61	26• 75	2• 5	6• 10	3• 7	3• 17	1• 2	4• 6	17• 24	37• 56																		492• 1397
52	Redwood City	8• 124	11	1• 5	1• 20	3• 16	4• 33	1• 19	28• 213	10• 116			1• 14	2• 19	1• 3	4	2	1• 1	1	2	3• 18																			64• 623
53	San Francisco	125• 761	6• 34	17• 30	11• 61	6• 40	16• 149	6• 57	113• 652	58• 120	34• 48	3	8• 43	17• 81	1• 6	5• 13	5• 13	2• 11	2• 8	7• 10	12• 36	15• 50	1•																	467• 2228
54	San Rafael	7• 52	6	2	7	2• 4	1• 6	3• 4	10• 42	8• 6	1• 3		1• 13	2• 14	2	2	1• 4	2• 1	2	3	1• 5	1• 7																		40• 185
55	Santa Rosa	18• 94	3• 8	2• 5	1• 8	1• 6	2• 18	6	26• 70	12• 28	9• 4	1• 1	2• 9	4• 17	3		1		1• 1	2•	4• 6		1																	88• 286
61	Tulare								2• 9		16• 45												13• 37	2• 10	13• 34	4• 6														50• 161
62	Visalia								2• 9		7• 36												9• 26	2• 7	24• 48	1• 5														45• 131
63	Fresno							6• 3	24• 107		75• 238												113• 270	12• 72	118• 343	20• 42														358• 1075
64	Madera								4• 14		9• 27												8• 25	2• 11	6• 30	2• 5														31• 112
71	Merced								1•		19• 41												35• 133		27• 166	7• 20														89• 360
72	Modesto				1	3	2• 6	1	5• 49		85• 203												142• 456		85• 390	8• 40														327• 1149
73	Manteca				1	1	1• 1	1• 1	4• 8	6• 3	35• 69												68• 154		34• 108	4• 4														153• 350
74	Tracy				1• 1	1	4	3	7• 34	2• 15	36• 71												101• 272		28• 105	4• 14														179• 520
81	Stockton				13	3• 9	3• 35	2• 14	40• 221	40• 42	206• 706														140• 534	4• 24														438• 1598
91	Bishop										2•												2		1															2• 3
92	Yosemite								9		3• 72												5• 347		6• 329	37														14• 794
93	Sonora							1	1• 3		7• 45												32• 168		13• 141	2• 7														55• 365
	TOTALS	519• 3194	25• 165	30• 118	33• 407	70• 281	201• 864	66• 218	599• 2520	238• 451	660• 1869	25• 59	21• 140	51• 206	4• 19	11• 29	9• 27	8• 32	4• 14	13• 21	37• 89	53• 113	527• 1891	18• 100	494• 2229	56• 204														3772• 15260

Tab.#9078
•Trucks

CHPS IT-5379

RDB:ljb 1/3/51

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

Route C

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS
MAXIMUM POTENTIAL

Centroid of each zone as indicated.

ZONE	CENTROID	ZONE 01	02	11	12	13	21	22	23	24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	TOTALS
01	Los Angeles																																							
02	San Bernardino																																							
11	Ventura																																							
12	Santa Barbara																																							
13	Santa Maria																																							
21	Paso Robles	58• 814	2• 33																																					60• 847
22	King City	14• 176	1• 1																																					15• 177
23	Salinas	23• 210	2• 7																																					25• 217
24	Gilroy	2• 25	1• 3																																					3• 28
25	San Jose	50• 217	4• 25	3• 16																																				57• 258
31	Gorman						1		3	2• 1	3																													2• 8
32	Barstow						16	4	1• 26	2	1• 17																													2• 65
33	Bakersfield						42• 125	9• 7	3• 32	5• 8	20• 56																													79• 228
41	Taft						26• 55	2	5	1• 1	5• 9																													32• 72
42	Delano							1	1• 4	9• 5	10• 19																													20• 29
43	Coalinga	10• 44	1• 2	3• 3						4	1• 10	1• 2	58• 81		67• 77	12• 21																								153• 244
44	Hanford			3						1• 3	2• 16				6• 2																									9• 24
45	Kerman	5• 7			1					4• 6	5• 8	1			3• 6																									17• 29
46	Mendota	6• 10	5• 6				3• 1			4• 3	6• 22	1• 1	4	7• 9	2• 2																									34• 58
47	Los Banos	8• 12	1• 3				2•					1	3	9• 6	2		6• 12																							26• 39
48	Newman	5• 15	1	1•	1		1					1•	3	3	1•	1•	1• 3	2• 3	2• 2	4• 6	32• 50																			50• 88
51	Oakland	137• 431	4• 28	3• 15	1• 39	2• 19	12• 75	9• 28	108• 340	74• 109	33• 48	1• 2	9• 61	26• 75	2• 5	6• 10	3• 7	3• 17	1• 2	4• 6	17• 24	37• 56																		492• 1397
52	Redwood City	8• 124	11	1• 5									1• 14	2• 19	1• 3	4	2	1• 3	1	2		8• 12																		22• 200
53	San Francisco	125• 761	6• 34	17• 30								3	8• 43	17• 81	1• 6	5• 13	5• 13	2• 11	2• 8	7• 10	12• 36	15• 50	1•																	223• 1099
54	San Rafael	7• 52	6	2									1• 13	2• 14	2	2	1• 4	2• 1	2	3	1• 5	1• 7																		15• 113
55	Santa Rosa	18• 94	3• 8	2• 5								1• 1	2• 9	4• 17	3	1• 4	1	3	1• 1	2•	4• 6	3• 6	1																	41• 159
61	Tulare																						13• 37		13• 34	4• 6	2• 11													32• 88
62	Visalia																						9• 26		24• 48	1• 5	1• 7													35• 86
63	Fresno			5• 34											15• 26								113• 270		118• 343	20• 42	15• 35													286• 750
64	Madera	13• 39		1		3						1			1								8• 25		6• 30	2• 5	3• 9													32• 114
71	Merced	20• 99		2	1	1•	2• 7					3			1• 3								35• 133	9• 26	27• 166	7• 20	7• 14													109• 474
72	Modesto	43• 134	4• 16	1• 5	1	3	2• 6				85• 203	1• 2	3• 22	14• 46	2• 3		4• 12				36• 83		142• 456	19• 72	85• 390	8• 40	1• 27													450• 1521
73	Manteca	12• 22	1• 2	1•	1	1	1• 1	1• 1	4• 8	6• 3	35• 69	1	1• 6	3• 4	1		2			3• 2	9• 7		68• 154	8• 29	34• 108	4• 4	1• 4													192• 430
74	Tracy	27• 44	1• 5	2	1• 1	1	4	3		2• 15	36• 71	1	1• 12	3• 14	1	1• 2	2• 1	1• 3	2	9• 11	3• 20	14• 42	101• 272	11• 27	28• 105	4• 14	1• 10	3• 9	2• 5	17• 42	1• 6	7• 24	23• 47							299• 816
81	Stockton	276• 764	14• 51	7• 24	13	3• 9	3• 35	2• 14	40• 221	40• 42	206• 706	2• 12	10• 52	59• 162	2• 8		13• 17			11• 23	44• 45	61• 96	250• 807	53• 220	140• 534	4• 24														1240• 3879
91	Bishop										2•												2		1															2• 3
92	Yosemite			4							3• 72												5• 347	1• 81	6• 329	37	1• 20													16• 893
93	Sonora	3• 17		1	1						7• 45												32• 168	2• 54	13• 141	2• 7	1													59• 435
	TOTALS	870• 4111	50• 242	44• 152	2• 59	6• 36	93• 327	21• 60	157• 639	148• 202	457• 1374	8• 31	94• 323	146• 450	103• 154	26• 56	35• 74	11• 41	6• 18	40• 63	158• 276	139• 269	777• 2698	103• 509	494• 2229	56• 204	32• 138	3• 9	2• 5	17• 42	1• 6	7• 24	23• 47							4129• 14868

Source: Tab. #9078

•Trucks

CHPS IT-5380

[illegible]/Jan. 4/51

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS
MAXIMUM POTENTIAL

Centroid of each zone as indicated.

24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	TOTALS
																														6• 87
																														17• 177
																														25• 217
																														3• 28
																														27• 258
2• 1	1																													2• 8
2	1• 17																													2• 65
5• 8	20• 56																													79• 228
1• 1	5• 9																													32• 72
9• 5	10• 19																													20• 29
4	1• 10	1• 2	58• 81		67• 77	12• 21																								153• 244
1• 3	2• 16				6• 2																									9• 24
4• 6	5• 8	1			3• 6																									18• 34
4• 3	6• 22	1• 1	4	7• 9	2• 2																									34• 63
	28• 43	1	3	9• 6	2		6• 12																							54• 82
1• 6	16• 39	1	3	3	1•		1• 3	2• 3																						29• 80
74• 109	33• 48	1• 2	9• 61	26• 75	2• 5	6• 10	3• 7	3• 17	1• 2	4• 6	17• 24	37• 56																		492• 1397
30• 116			1• 14	2• 19	1• 3	4	2	1• 3	1	2	3• 18																			64• 623
98• 120	34• 48	3	8• 43	17• 81	1• 6	5• 13	5• 13	2• 11	2• 8	7• 10	12• 36	15• 50	1•																	467• 2227
8• 6	1• 3		1• 13	2• 14	2	2	1• 4	2• 1	2	3	1• 5	1• 7																		40• 185
12• 28	9• 4	1• 1	2• 9	4• 17	3	1• 4	1	3	1• 1	2•	4• 6		1																	89• 293
2• 9	16• 45												13• 37	2• 10	13• 34	4• 6	2• 11													52• 152
4• 4	7• 36												9• 26	2• 7	24• 48	1• 5	1• 7													48• 133
24• 61	75• 238				15• 26								113• 270	12• 72	118• 343	20• 42	15• 35													421• 1228
4• 9	9• 27	1			1								8• 25	2• 11	6• 30	2• 5	3• 9													51• 175
	19• 41	3			1• 3								35• 133	9• 26	27• 166	7• 20														122• 501
12• 17	85• 203	1• 2	3• 22	14• 46	2• 3		4• 12						142• 456		85• 390	8• 40														411• 1406
6• 3	35• 69	1	1• 6	3• 4	1		2						68• 154		34• 108	4• 4														171• 388
2• 15	36• 71	1	1• 12	3• 14	1		2• 1						101• 272		28• 105	4• 14														213• 600
40• 42	206• 706	2• 12	10• 52	59• 162	2• 8		13• 17								140• 534	4• 24														821• 2688
	2•												2		1															2• 3
2	3• 72				3								5• 347		6• 329	37														14• 803
	7• 45												32• 168		13• 141	2• 7														57• 380
303• 580	671• 1898	8• 31	94• 323	146• 450	103• 154	24• 54	35• 74	10• 38	4• 14	13• 21	37• 89	53• 113	527• 1891	27• 126	494• 2229	56• 204	21• 62													4147• 15637

CHPS IT-5381

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

Route C1

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS
MAXIMUM POTENTIAL

Centroid of each zone as indicated.

ZONE	CENTROID	01	02	11	12	13	21	22	23	24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81	91	92	93	TOTALS
01	Los Angeles																																							
02	San Bernardino																																							
11	Ventura																																							
12	Santa Barbara																																							
13	Santa Maria																																							
21	Paso Robles	58° 814	2° 11																																					[illegible]
22	King City	16° 176	1° 1																																					[illegible]
23	Salinas	23° 210	2° 7																																					[illegible]
24	Gilroy	2° 25	1° 1																																					[illegible]
25	San Jose	50° 217	6° 25	3° 16																																				[illegible]
31	Gorman						1		1	2° 1	1																													[illegible]
32	Barstow						16	4	1° 26	2	1° 17																													[illegible]
33	Bakersfield						62° 125	9° 7	3° 12	3° 8	20° 56																													[illegible]
41	Taft						26° 55	2	5	1° 1	7° 9																													[illegible]
42	Delano							1	1° 4	9° 5	10° 19																													[illegible]
43	Coalinga	10° 44	1° 2	3° 3						4	1° 10	1° 2	58° 61		67° 77	12° 21																								[illegible]
44	Hanford			1						1° 1	2° 16				6° 2																									[illegible]
45	Kerman	5° 7			1				1° 5	4° 6	5° 8				1° 6																									[illegible]
46	Mendota	6° 10	5° 6				1° 1		5	4° 1	6° 22	1° 1	4	7° 5	2° 2																									[illegible]
47	Los Banos	8° 12	1° 3				2°				20° 43	1	3	6° 6	2		6° 12																							[illegible]
48	[illegible]	5° 15	1	1°	1		1		1° 5	1° 6	16° 19	1			1°		1° 1	2° 1																						[illegible]
51	Oakland	137° 451	4° 28	3° 13	1° 19	24 19	12° 75	9° 28	108° 140	75° 109	11° 68	1° 2	9° 61	26° 75	2° 5	6° 10	1° 9	1° 11	1° 2	4° 6	17° 24	17° 34																		[illegible]
52	Redwood City	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28° 211	30° 116	[illegible]		3° 14	2° 19	3	4	2	3	3	3	3° 10																			[illegible]
53	San Francisco	[illegible] 79	[illegible] 35	17° 30	12° 61	40	16° 149	57	11° 652	[illegible] 120	[illegible]	1	61	17° 81	3° 8	11	11	11	8	10	12° 36	15° 50	1°																	[illegible]
54	San Rafael	7° 52	6	2	2	2° 4	1° 6	1° 4	16° 62	8° 6	1° 1		1° 13	2° 14	2	2	1° 4	2° 1	2	1	1° 5	1° 2																		[illegible]
55	Santa Rosa	18° 35	1° 8	2° 5	1° 8	1° 6	3° 18	6	26° 70	12° 28	1° 4	1° 1	2° 9	6° 17	3	1° 4	1	1	1° 1		6° 6																			[illegible]
61	Tulare									2° 9	16° 65												[illegible]	5° 10	11° [illegible]	4° 4	1° 4													[illegible]
62	Visalia									4° 4	7° 36												26	7	58	5	7													[illegible]
63	Fresno			5° 36					24° 107	24° 61	75° 234				15° 26								113° 270	12° 73	118° 143	20° 45	11° 33													[illegible]
64	Madera	17° 15		1					6° 34	4° 9	9° 27	1											8° 25	3° 4	8° 10	3° 4	3													[illegible]
71	Merced	20° [illegible]		2	1	1°	2° 7		[illegible]		[illegible]	1			1° 1								[illegible]	[illegible]	[illegible]	[illegible]														[illegible]
72	Modesto	53° 146	6° 16	1° 5	1	1	2° 6	1	9° 49	12° 17	85° 201	1° 2	3° 22	14° 46	2° 1		4° 12						162° 456		84° 180	8° 48														[illegible]
73	Manteca	15° 22	1° 2	1°	1	1	1° 1	1° 1	6° 8	6° 3	13° 69	1	1° 6	1° 6	1		2						68° 134		16° 108	6° 4														[illegible]
74	Tracy	27° 45	1° 5	1	1° 1	1	4	1	7° 34	2° 15	36° 72	1	1° 12	3° 16	1		2° 1						101° 272		28° 103	4° 14														[illegible]
81	Stockton	276° 704	16° 51	1° 26	11	1° 9	1° 35	2° 14	60° 221	40° 42	206° 706	3° 12	10° 52	39° 162	3° 8		13° 17								126° 534	6° 24														[illegible]
91	Bishop										2°												2		1															[illegible]
92	Yosemite			4					9	2	3° 72				1								3° 142		11° 143	37														[illegible]
93	Sonora	3° 17		1	1						7° 45												12° 146		13° 141	3° 7														[illegible]
	TOTALS	870° 4113	50° 262	44° 152	15° 155	18° 100	116° 533	31° 167	377° 1844	103° 580	671° 1898	8° 32	94° 323	146° 650	103° 156	24° 54	35° 56	10° 38	4° 14	13° 21	37° 89	51° 113	527° 1891	27° 126	646° 2229	56° 204	23° 62													[illegible]

Source: Tab. [illegible]

[illegible] 1-4-52

[illegible]

STATE OF CALIFORNIA
DIVISION OF HIGHWAYS

Route D

LOS ANGELES - SAN FRANCISCO TOLL ROAD STUDY
INTERCHANGE OF AUTO AND TRUCK TRIPS
MAXIMUM POTENTIAL

Centroid of each zone as indicated.

ZONE	CENTROID	ZONE 01	02	11	12	13	21	22	23	24	25	31	32	33	41	42	43	44	45	46	47	48	51	52	53	54	55	61	62	63	64	71	72	73	74	81		92	93	TOTAL
01	Los Angeles																																							
02	San Bernardino																																							
11	Ventura																																							
12	Santa Barbara																																							
13	Santa Maria																																							
21	Paso Robles	58* 814	2* 33																																					60* 847
22	King City	14* 176	1* 1																																					15* 177
23	Salinas	23* 210	2* 7																																					25* 217
24	Gilroy	2* 25	1* 3																																					3* 28
25	San Jose	50* 217	4* 25																																					54* 242
31	Gorman						1		3	2* 1	3																													2* 8
32	Barstow						16	4	1* 26	2	1* 17																													2* 65
33	Bakersfield						42* 125	9* 7	3* 32	5* 8	20* 56																													79* 228
41	Taft																																							
42	Delano	110* 189	5* 13	13	1* 7			1	1* 4	9* 5	10* 19	2* 14			1* 4																									139* 269
43	Coalinga	10* 44	1* 2									1* 2	58* 81			12* 21																								82* 150
44	Hanford	21* 76	5	3					3	1* 3	2* 16	1* 3	1* 9	32* 36	6* 2	11* 8																								75* 164
45	Kerman	5* 7							1* 5	4* 6	5* 8	1	1* 3	10* 4	3* 6	1																								29* 41
46	Mendota	6* 10	5* 6									1* 1	4	7* 9	2* 2	1* 3		4* 5																						26* 40
47	Los Banos	8* 12	1* 3									1	3	9* 6	2	[illegible]		3* 6	7* 13																					28* 48
48	Newman	5* 15	1	1*	1							1*	3	3	1*	1*	1* 3	2* 3	2* 2																					14* 31
51	Oakland	137* 431	4* 28	3* 15	1* 39	2* 19	12* 75	9* 28	108* 340	74* 109	33* 48	1* 2	9* 61	26* 75	2 5	6* 10	3* 7	3* 17	1* 2	4* 6	17* 24	37* 56																		492* 1397
52	Redwood City	8* 124	11										1* 14	2* 19		4		1* 3	1			8* 12																		20* 188
53	San Francisco	125* 761	6* 34	17* 30								3	8* 43	17* 81	1* 6	5* 13		2* 11	2* 8	7* 10	12* 36	15* 50	1*																	218* 1086
54	San Rafael	7* 52	6	2									1* 13	2* 14	2	2		2* 1	2	3	1* 5	1* 7																		14* 109
55	Santa Rosa	18* 94	3* 8	2* 5								1* 1	2* 9	4* 17	3	1* 4		3	1* 1	2*	4* 6	3* 6	1																	41* 158
61	Tulare	134* 264	1* 16	3* 11	2* 14				2* 9	2* 9	16* 45	3* 7			9* 8				1* 4	3* 5	4* 13	8* 4	13* 37	2* 10	13* 34	1* 6	2* 11													222* 507
62	Visalia	60* 289	1* 14	2* 9	1* 11				2* 9	4* 4	7* 36	3* 4			3* 7				7	3* 3	1* 10	5	9* 26	2* 7	24* 48	1* 5	1* 7													124* 501
63	Fresno	304* 911	15* 66	5* 34					24* 107	24* 61	72* 238	12* 20	238* 488	5* 16	15* 26	62* 167		6* 20			70* 214	23* 33	113* 270	12* 72	118* 343	26* 42	15* 35													1156* 3163
64	Madera	13* 39	2	1								1	2* 3	6* 16	1	2* 5						6* 8	8* 25	2* 11	6* 30	2* 5	3* 9													50* 156
71	Merced	20* 99	2* 7	2	1	1*	2* 7				19* 41	3	2* 13	23* 27	1* 3	9* 7	12* 7	5* 9	6* 15			4* 15	35* 133	9* 26	27* 166	7* 20	7* 14	6* 22	7* 26											204* 663
72	Modesto	43* 134	4* 16	1* 5	1	3	2* 6				85* 203	1* 2	3* 22	14* 46	2* 3	8* 12	4* 12	5* 9	4* 5	11* 18			142* 456	19* 74	85* 390	8* 40	1* 27	13* 39	7* 23	91* 258	21* 56									574* 1858
73	Manteca	12* 22	1* 2	1*	1	1	1* 1		4* 8	6* 3	35* 69	1	1* 6	3* 4	1	3	2	1* 2	1* 1	3* 2			68* 154	8* 29	34* 108	4* 4	1* 4	2* 3	1* 4	12* 30	2* 4									201* 469
74	Tracy	27* 44	1* 5	2	1* 1	1	4	3	7* 34	2* 15	36* 71	1	1* 12	3* 14	1	1* 2	2* 1	1* 3	2	9* 11	3* 20	14* 42	101* 272	11* 27	28* 105	4* 14	1* 10	3* 9	2* 5	17* 42	1* 6	7* 24	23* 47							306* 850
81	Stockton	276* 764	14* 51	7* 24	13	3* 9	3* 35		40* 221	40* 42	206* 706	2* 12	10* 52	59* 162	2* 8	15* 44	13* 17	12* 20	3* 12	11* 23			250* 807	53* 220	140* 534	4* 24		35* 97	17* 64	220* 573	34* 66									1469* 4600
91	Bishop										2*											1	2		1															2* 4
92	Yosemite	3* 243	1* 5	4							3* 72	3	4	1* 26	3	3						3	5* 347	1* 81	6* 329	37	1* 20													21* 1180
93	Sonora	3* 17	1	1	1						7* 45		1* 3			1		1*					32* 168	2* 54	13* 141	2* 7	1	1	1* 1											62* 442
	TOTALS	1502* 6083	75* 371	42* 161	6* 90	6* 33	62* 270	18* 43	193* 801	173* 268	562* 1693	29* 82	339* 846	223* 575	48* 93	134* 312	35* 49	48* 112	28* 75	53* 81	112* 328	119* 242	777* 2698	121* 609	494* 2229	56* 204	32* 138	59* 171	35* 123	340* 903	58* 132	7* 24	23* 47							5809* 19886

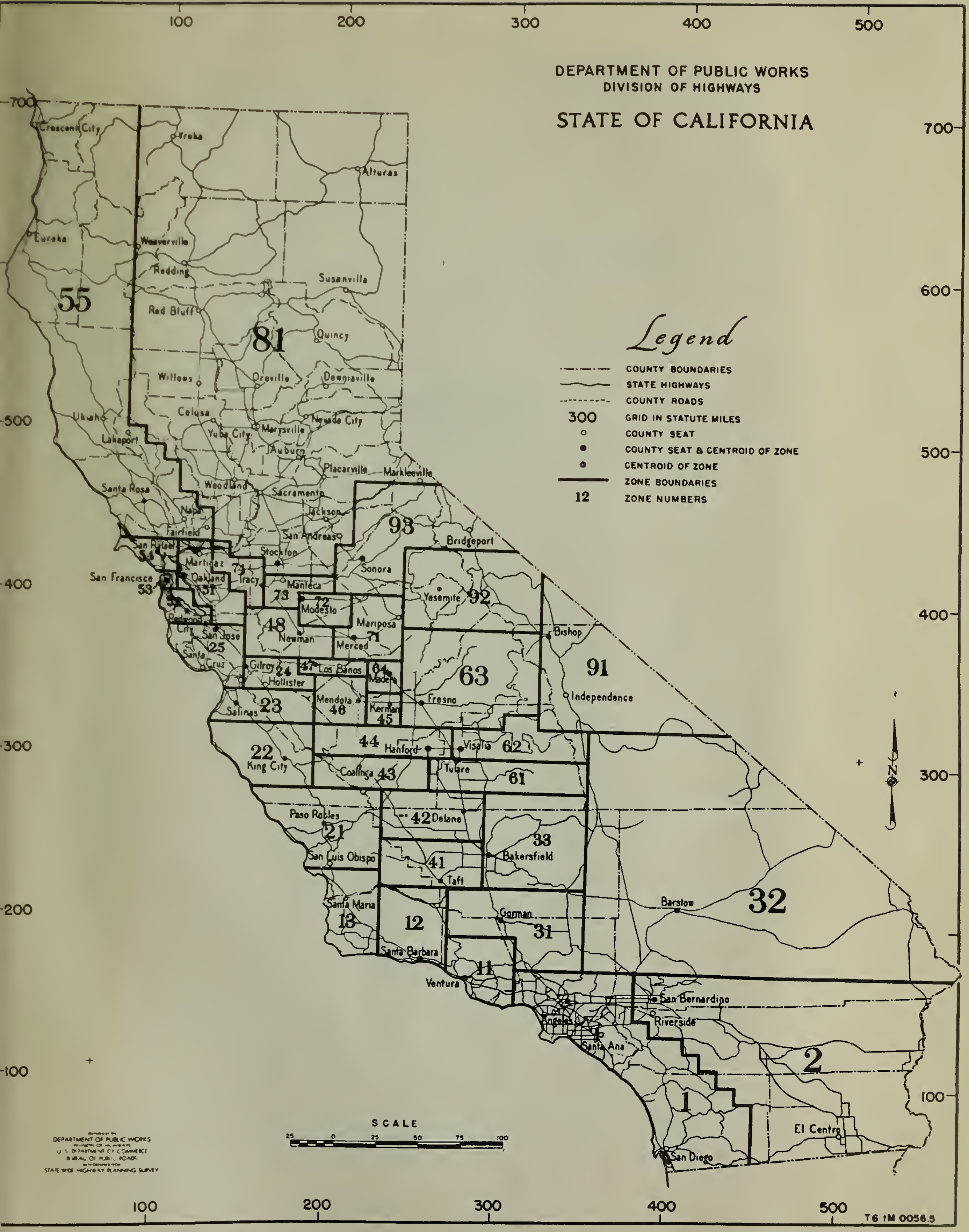
Source: Tab. #9078

*Trucks

ROB:ljb/1-4-51

CHPS IT-5382

[illegible]


DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
STATE OF CALIFORNIA
Legend
COUNTY BOUNDARIES
STATE HIGHWAYS
COUNTY ROADS
300 GRID IN STATUTE MILES
COUNTY SEAT
COUNTY SEAT & CENTROID OF ZONE
CENTROID OF ZONE
ZONE BOUNDARIES
12 ZONE NUMBERS
100
200
300
400
500
600
700
Crescent City
Yreka
Alturas
Eureka
Weaverville
Redding
Susanville
55
Red Bluff
81
Quincy
Willows
Oroville
Downieville
Colusa
Ukiah
Nevada City
Yuba City
Marysville
Lakeport
Auburn
Placerville
Markleeville
Santa Rosa
Woodland
Sacramento
Napa
Jackson
93
Fairfield
San Andreas
Bridgeport
San Rafael
54
Stockton
Sonora
Martinez
74
San Francisco
Oakland
Tracy
53
51
Manteca
73
72
Yosemite
92
Modesto
52
Redwood City
48
Mariposa
Bishop
San Jose
Newman
71
25
Merced
Santa Cruz
63
91
Gilroy
24
47
Los Banos
64
Madera
Hollister
Independence
Mendota
Fresno
23
46
Kerman
Salinas
45
44
Hanford
Visalia
62
22
King City
Coalinga
43
Tulare
61
N
Paso Robles
42
Delano
21
33
San Luis Obispo
Bakersfield
41
Taft
Barstow
32
Santa Maria
12
Gorman
13
31
Santa Barbara
11
Ventura
San Bernardino
Los Angeles
Riverside
Santa Ana
2
1
El Centro
San Diego
SCALE
25
0
25
50
75
100
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
STATE WIDE HIGHWAY PLANNING SURVEY
T6 1M 0056.5